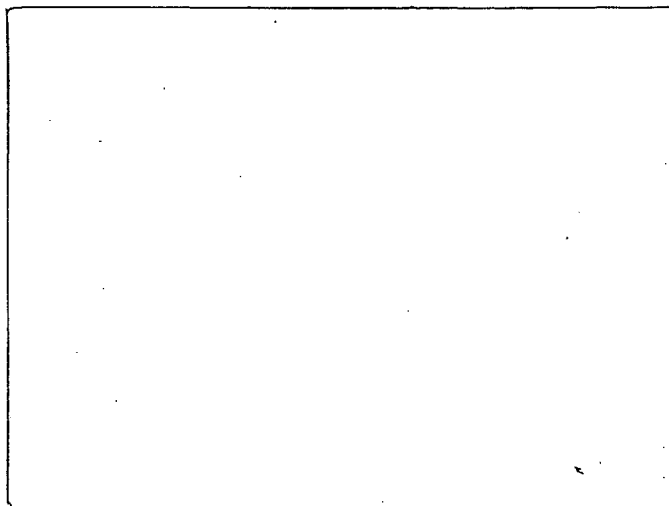


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U.S. ENVIRONMENTAL PROTECTION AGENCY



DIVISION OF ENVIRONMENTAL SCIENCE AND ASSESSMENT

REGION 2

EDISON, NEW JERSEY



**Sampling Report
Data Presentation**

**JEWETT WHITE LEAD COMPANY
Staten Island, New York**

**Shallow Soil Sampling
December 15, 2008**

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1.0 BACKGROUND

Sedutto's Ice Cream Factory site is a former ice cream factory located at the corner of Richmond Terrace and Park Ave. The address is 2000 Richmond Terrace, Port Richmond, Block 1006, lot 32, New York. The site is in a manufacturing zone with business adjoining the site and residential housing within 90 feet of the site.

From 1839 to 1898, the property was owned by Jewett & Son's White Lead Company, where white lead was produced. In 1898, the property was sold to National Lead Industries and producers of Dutch Boy Paints. Between 1949 and 1990 the property switched hands through a myriad of private owners and was recently purchased as a speculative venture.

In June 2008, the Council of the City of New York requested that EPA review the site as a potential Brownfield location. In July 2008, The Division of Environmental Science and Assessment (DESA), Hazardous Waste Support Branch (HWSB), Superfund Support Team (SST) has been requested by the EPA Emergency Remedial and Response Division (ERRD) to conduct a sampling event to assist in characterization of the soils within the site property boundaries.

2.0 SAMPLING PROCEDURES

Sixteen test holes approximately 4 feet in depth were sampled at surface, one foot, two feet and three feet in depth for TAL metals and selected location for TCL PCBs. Four surface sample points along the outside perimeter of the site and two background sample point sampled at surface and one foot in depth in Veterans Park for TAL metals and TCL PCBs. The sampling procedures were in accordance with the USEPA, Environmental Response Team, Standard Operating Procedure # 2012, dated January 1991.

3.0 DESCRIPTION OF THE EVENTS

On December 15, 2008, Michael A. Mercado traveled to the site and coordinated with the Site's OSC, Nick Magriples. During the morning the Michael Mercado with the assistance of the OSC measured out and flagged the grid locations. The grids were labeled from south to north A, B, C, D, E, & F. From west to east the grids were labeled 1, 2, 3, 4, 5, & 6. (See sampling grid map Annex A) Each of the sixteen grids along with two outside perimeter and G-2-0 which is a laboratory blind duplicate of D-2-0, were sampled by Michael A. Mercado at the surface for TAL metals. All samples were placed in a cooler with ice for the return trip to Edison, NJ and secured overnight.

On December 16, 2008, samples for TAL metals were hand delivered to the USEPA Mobile Laboratory in Edison, NJ. The samples were packed in a cooler with wet ice.

On December 17, 2008, the sampling team consisting of Michael A. Mercado and Joseph Hudek traveled to the site and collected samples. Grids sampling locations Cs, Ds, & Es were sampled at a depth of 1', 2', and 3' for TAL metals. Grid sampling locations C-1-3, C-2-2, C-3-2, D-1-1, D-2-2, E-1-3 and E-2-2 were sampled for TCL PCBs. A rinsate named RB-01 was collected for both TAL metals and TCL PCBs. All samples were placed in a cooler with ice for the return trip to Edison, NJ and secured overnight.

On December 18, 2008, the sampling team consisting of Michael A. Mercado and Joseph Hudek

traveled to the site and collected samples. Grids sampling locations As & Bs were sampled at a depth of 1', 2', and 3' for TAL metals. Grid sampling locations A-1-1, A-2-3, A-3-2, A-4-3, A-5-1, B-1-2, B-2-2, B-3-3, and B-4-3 were sampled in addition for TCL PCBs. Background samples BG-1-1 and BG-2-1 along with rinsate named RB-02 were collected for both TAL metals and TCL PCBs. Three laboratory blind duplicate samples were collected from A-3-3 named G-3-3, A-5-1 named G-5-1, and B-2-2 named G-2-2. Sample G-2-2 was collected for both TAL metals and TCL PCBs the other two laboratory blind were collected for only TAL metals analysis. All samples were placed in a cooler with ice for the return trip to Edison, NJ.

Samples for TAL metals were hand delivered to the USEPA Mobile Laboratory in Edison, NJ for analysis. The samples were packed in two cooler with wet ice. Samples for TCL PBCs were hand delivered to the USEPA Laboratory in Edison, NJ for analysis. The samples were packed in a cooler with wet ice.

4.0 RESULTS

The purpose of this sampling event was to evaluate the potential for lead and PCB contamination present at the site based on the historical activities that took place beginning in the 1800's. This would be verified through the chemical analysis of surface soil samples that there had been an established release of such contaminants. A release is established if the sample concentration is three times higher than the background sample concentration, and can be attributable to the site.

As stated in the introduction, lead compounds were used and produced on the site since the 1800's. A summary of the analytical results for inorganic contaminants is listed in Table 3 for TAL Metals. The tables identify the sample sources containing detectable levels of targeted analyte. Lead was detected above both the State and Federal authorized levels in 68 of the 68 sample points.

The highest lead background sample was detected at 516 ppm. In order to establish a release, at least one of samples would have to be above 1548 ppm. Based on this sampling event, the following locations were detected with levels above three times the background concentration: A-1-1, A-1-2, A-2-0, A-2-1, A-2-2, A-2-3, A-4-1, A-4-2, A-4-3, A-5-0, A-5-1, A-5-2, A-5-3, B-1-0, B-1-1, B-1-2, B-2-1, B-2-2, B-2-3, B-3-1, B-3-2, B-3-3, B-4-1, B-4-2, B-4-3, C-1-0, C-1-1, C-1-2, C-1-3, C-2-1, C-2-2, C-2-3, C-3-1, C-3-2, C-3-3, D-1-0, D-1-2, E-1-1, E-1-2, E-1-3, E-2-0, E-2-1, & E-2-2.

In addition to the aforementioned sampling points, three of the four samples taken from the outside perimeter of the site were detected above the State and Federal levels, and one of these three samples was detected three times above the background.

The sample data for TAL metals for this sampling event were obtained from EPA Region II, Mobile Laboratory in Edison, NJ for TAL metals. There were no PCBs detected in any of the samples provided for analysis by the EPA Region II Laboratory in Edison, NJ. The data sheets are attached in Annex B for PCBs and C for TAL metals.

5.0 CONCLUSION

The Jewett White Lead site historically used lead in its manufacturing operations. Four hundred part per million (ppm) is maximum soil screening level for both Federal and New York State. The chemical analyses of surface soil samples for this sampling event detected lead

concentrations above the New York State and Federal soil screening levels as well as three time above background concentrations for samples both on-site and from outside the perimeter locations. Therefore, it can be concluded that there is a release of lead on-site, with the possible release of lead off-site.

TABLE 1
QA/QC SAMPLE IDENTIFICATION

TYPE OF SAMPLE	SAMPLE NUMBERS	SAMPLE LOCATION
RINSATE	RB-01/MB5B15-B5B15 RB-02/MB5B16-B5B16	RB-01 RB-02
MS/MSD	A-1-1/MB5B22-B5B22 B-4-3/MB5B56 C-3-2/MB5B67 E-1-0/MB5B77	A-1-1 B-4-3 C-3-2 E-1-0
LAB BLIND DUPLICATE	G-2-0/MB5B81 G-2-2/MB5B82-B5B82 G-3-3/MB5B83 G-5-1/MB5B84	D-2-0 B-2-2 A-3-3 A-5-1
BACKGROUND SAMPLES	BG-1-0/MB5B17 BG-1-1/MB5B89/B5B89 BG-2-0/MB5B90 BG-2-1/MB5B20/B5B20	BG-1-0 BG-1-1 BG-2-0 BG-2-1

TABLE 2
TCL PCBs Analytical Results

Sample Location	CLP Number	PARAMETERS				Remarks
		CAS Number	Analyte	Result	Q	
RB-01	B5B15		Non-Detected			
RB-02	B5B16		Non-Detected			
BG-1-1	B5B89		Non-Detected			
BG-2-1	B5B20		Non-Detected			
A-1-1	B5B22		Non-Detected			
A-2-3	B5B28		Non-Detected			
A-3-2	B5B31		Non-Detected			
A-4-3	B5B36		Non-Detected			
A-5-1	B5B38		Non-Detected			
B-1-2	B5B43		Non-Detected			
B-2-2	B5B47		Non-Detected			
B-3-3	B5B52		Non-Detected			
B-4-3	B5B56		Non-Detected			
C-1-3	B5B60		Non-Detected			
C-2-2	B5B63		Non-Detected			
C-3-2	B5B67		Non-Detected			
D-1-1	B5B70		Non-Detected			
D-2-2	B5B75		Non-Detected			
E-1-3	B5B80		Non-Detected			
E-2-2	B5B87		Non-Detected			
G-2-2	B5B82		Non-Detected			

TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
RB-1	MB5B15	7429-90-5	Aluminum	0.52	U	
		7440-36-0	Antimony	3.08	B	
		7440-38-2	Arsenic	1.92	B	
		7440-39-3	Barium	0.80	B	
		7440-41-7	Beryllium	0.30	U	
		7440-43-9	Cadmium	0.09	U	
		7440-70-2	Calcium	1.65	U	
		7440-47-3	Chromium	14.10		
		7440-48-4	Cobalt	0.19	B	
		7440-50-8	Copper	39.50		
		7439-89-6	Iron	2670.00		
		7439-92-1	Lead	25.20		
		7439-95-4	Magnesium	44.40	B	
		7439-96-5	Manganese	14.70	BJ	
		7439-97-6	Mercury	0.05	U	
		7440-02-0	Nickel	4.01	B	
		7440-09-7	Potassium	452.00	B	
		7782-49-2	Selenium	6.85	B	
		7440-22-4	Silver	0.01	UJ	
		7440-23-5	Sodium	2110.00	B	
		7440-28-0	Thallium	1.40	BJ	
		7440-62-2	Vanadium	1.52	B	
		7440-66-6	Zinc	0.16	UJ	
RB-2	MB5B6	7429-90-5	Aluminum	0.52	U	
		7440-36-0	Antimony	2.49	B	
		7440-38-2	Arsenic	1.53	B	
		7440-39-3	Barium	0.03	U	
		7440-41-7	Beryllium	0.30	U	
		7440-43-9	Cadmium	0.09	U	
		7440-70-2	Calcium	157.00	B	
		7440-47-3	Chromium	24.10		
		7440-48-4	Cobalt	0.02	U	
		7440-50-8	Copper	46.10		
		7439-89-6	Iron	41.80	B	
		7439-92-1	Lead	0.02	U	
		7439-95-4	Magnesium	16.01	B	
		7439-96-5	Manganese	0.99	BJ	
		7439-97-6	Mercury	0.05	U	
		7440-02-0	Nickel	6.35	B	
		7440-09-7	Potassium	233.00	B	
		7782-49-2	Selenium	6.64	B	
		7440-22-4	Silver	0.01	UJ	
		7440-23-5	Sodium	1780.00	B	
		7440-28-0	Thallium	0.69	BJ	
		7440-62-2	Vanadium	1.11	B	
		7440-66-6	Zinc	0.16	UJ	

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
BG-1-0	MB5B17	7429-90-5	Aluminum	1510.00		
		7440-36-0	Antimony	0.09	BJ	
		7440-38-2	Arsenic	1.44	B	
		7440-39-3	Barium	16.90	B	
		7440-41-7	Beryllium	0.11	B	
		7440-43-9	Cadmium	0.08	B	
		7440-70-2	Calcium	1390.00		
		7440-47-3	Chromium	4.53	J	
		7440-48-4	Cobalt	1.22	BJ	
		7440-50-8	Copper	11.30		
		7439-89-6	Iron	2230.00	J	
		7439-92-1	Lead	32.90		
		7439-95-4	Magnesium	573.00	B	
		7439-96-5	Manganese	62.90		
		7439-97-6	Mercury	0.05	J	
		7440-02-0	Nickel	8.89	J	
		7440-09-7	Potassium	181.00	B	
		7782-49-2	Selenium	0.10	BJ	
		7440-22-4	Silver	0.05	BJ	
		7440-23-5	Sodium	74.20	BJ	
		7440-28-0	Thallium	0.03	BJ	
		7440-62-2	Vanadium	4.01	B	
		7440-66-6	Zinc	21.50		
BG-1-1	MB5B89	7429-90-5	Aluminum	12000.00		
		7440-36-0	Antimony	0.72	BJ	
		7440-38-2	Arsenic	10.80		
		7440-39-3	Barium	134.00		
		7440-41-7	Beryllium	0.89		
		7440-43-9	Cadmium	0.71	J	
		7440-70-2	Calcium	8120.00		
		7440-47-3	Chromium	33.00	J	
		7440-48-4	Cobalt	9.97	J	
		7440-50-8	Copper	88.40		
		7439-89-6	Iron	17700.00	J	
		7439-92-1	Lead	305.00		
		7439-95-4	Magnesium	3720.00		
		7439-96-5	Manganese	454.00		
		7439-97-6	Mercury	0.39	J	
		7440-02-0	Nickel	81.70	J	
		7440-09-7	Potassium	1790.00		
		7782-49-2	Selenium	0.81	BJ	
		7440-22-4	Silver	0.43	BJ	
		7440-23-5	Sodium	462.00	BJ	
		7440-28-0	Thallium	0.21	BJ	
		7440-62-2	Vanadium	31.70		
		7440-66-6	Zinc	202.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
BG-2-0	MB5B90	7429-90-5	Aluminum	10700.00		
		7440-36-0	Antimony	0.81	BJ	
		7440-38-2	Arsenic	52.40		
		7440-39-3	Barium	181.00		
		7440-41-7	Beryllium	0.68		
		7440-43-9	Cadmium	1.26	J	
		7440-70-2	Calcium	17300.00		
		7440-47-3	Chromium	33.00	J	
		7440-48-4	Cobalt	12.30	J	
		7440-50-8	Copper	97.20		
		7439-89-6	Iron	20300.00	J	
		7439-92-1	Lead	406.00		>SSL
		7439-95-4	Magnesium	5029.00		
		7439-96-5	Manganese	579.00		
		7439-97-6	Mercury	0.42	J	
		7440-02-0	Nickel	37.60	J	
		7440-09-7	Potassium	1350.00		
		7782-49-2	Selenium	0.45	BJ	
		7440-22-4	Silver	0.55	BJ	
		7440-23-5	Sodium	512.00	J	
		7440-28-0	Thallium	0.19	BJ	
		7440-62-2	Vanadium	44.70		
		7440-66-6	Zinc	237.00		
BG-2-1	MB5B20	7429-90-5	Aluminum	10100.00		
		7440-36-0	Antimony	0.56	BJ	
		7440-38-2	Arsenic	81.50		
		7440-39-3	Barium	108.00		
		7440-41-7	Beryllium	0.70		
		7440-43-9	Cadmium	0.87	J	
		7440-70-2	Calcium	6590.00		
		7440-47-3	Chromium	42.00	J	
		7440-48-4	Cobalt	7.73	J	
		7440-50-8	Copper	59.10		
		7439-89-6	Iron	16600.00	J	
		7439-92-1	Lead	516.00		>SSL
		7439-95-4	Magnesium	3020.00		
		7439-96-5	Manganese	389.00		
		7439-97-6	Mercury	0.36	J	
		7440-02-0	Nickel	39.00	J	
		7440-09-7	Potassium	726.00		
		7782-49-2	Selenium	0.80	BJ	
		7440-22-4	Silver	0.78	BJ	
		7440-23-5	Sodium	259.00	BJ	
		7440-28-0	Thallium	0.20	BJ	
		7440-62-2	Vanadium	48.40		
		7440-66-6	Zinc	232.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
O-1 _i	MB5B18	7429-90-5	Aluminum	11500.00		
		7440-36-0	Antimony	0.93	BJ	
		7440-38-2	Arsenic	7.61		
		7440-39-3	Barium	258.00		
		7440-41-7	Beryllium	0.97		
		7440-43-9	Cadmium	1.24	J	
		7440-70-2	Calcium	25600.00		
		7440-47-3	Chromium	62.80	J	
		7440-48-4	Cobalt	18.20	J	
		7440-50-8	Copper	239.00		
		7439-89-6	Iron	30600.00	J	
		7439-92-1	Lead	2760.00		>SSL & BG
		7439-95-4	Magnesium	14020.00		
		7439-96-5	Manganese	592.00		
		7439-97-6	Mercury	0.32	J	
		7440-02-0	Nickel	154.00	J	
		7440-09-7	Potassium	1850.00		
		7782-49-2	Selenium	0.34	BJ	
		7440-22-4	Silver	0.69	BJ	
		7440-23-5	Sodium	542.00	J	
		7440-28-0	Thallium	0.23	BJ	
O-2	MB5B19	7440-62-2	Vanadium	43.10		
		7440-66-6	Zinc	919.00		
		7429-90-5	Aluminum	3706.00		
		7440-36-0	Antimony	0.62	BJ	
		7440-38-2	Arsenic	2.49		
		7440-39-3	Barium	70.30		
		7440-41-7	Beryllium	0.22	B	
		7440-43-9	Cadmium	0.29	J	
		7440-70-2	Calcium	14400.00		
		7440-47-3	Chromium	45.50	J	
		7440-48-4	Cobalt	5.90	J	
		7440-50-8	Copper	62.10		
		7439-89-6	Iron	13800.00	J	
		7439-92-1	Lead	383.00		
		7439-95-4	Magnesium	7960.00		
		7439-96-5	Manganese	189.00		
		7439-97-6	Mercury	0.05	J	
		7440-02-0	Nickel	69.80	J	
		7440-09-7	Potassium	861.00		
		7782-49-2	Selenium	0.16	BJ	
		7440-22-4	Silver	1.58	BJ	
		7440-23-5	Sodium	448.00	J	
		7440-28-0	Thallium	0.12	BJ	
		7440-62-2	Vanadium	16.00		
		7440-66-6	Zinc	276.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
O-3	MB5B91	7429-90-5	Aluminum	4270.00		
		7440-36-0	Antimony	0.60	B	
		7440-38-2	Arsenic	2.18		
		7440-39-3	Barium	79.70	J	
		7440-41-7	Beryllium	0.34	B	
		7440-43-9	Cadmium	0.35	BJ	
		7440-70-2	Calcium	20700.00		
		7440-47-3	Chromium	51.60	J	
		7440-48-4	Cobalt	5.33	J	
		7440-50-8	Copper	71.10		
		7439-89-6	Iron	16100.00		
		7439-92-1	Lead	578.00	J	>SSL
		7439-95-4	Magnesium	9702.00		
		7439-96-5	Manganese	243.00	J	
		7439-97-6	Mercury	0.11	J	
		7440-02-0	Nickel	49.20	J	
		7440-09-7	Potassium	922.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.17	BJ	
		7440-23-5	Sodium	715.00	J	
		7440-28-0	Thallium	0.17	B	
		7440-62-2	Vanadium	15.30		
		7440-66-6	Zinc	256.00	J	
O-4	MB5B92	7429-90-5	Aluminum	6180.0		
		7440-36-0	Antimony	1.62	B	
		7440-38-2	Arsenic	4.14		
		7440-39-3	Barium	156.00	J	
		7440-41-7	Beryllium	0.35	B	
		7440-43-9	Cadmium	0.70	J	
		7440-70-2	Calcium	23500.00		
		7440-47-3	Chromium	47.20	J	
		7440-48-4	Cobalt	8.49	J	
		7440-50-8	Copper	206.00		
		7439-89-6	Iron	26200.00		
		7439-92-1	Lead	682.00	J	>SSL
		7439-95-4	Magnesium	10700.00		
		7439-96-5	Manganese	365.00	J	
		7439-97-6	Mercury	0.18	J	
		7440-02-0	Nickel	55.30	J	
		7440-09-7	Potassium	1150.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.36	BJ	
		7440-23-5	Sodium	865.00	J	
		7440-28-0	Thallium	0.16	B	
		7440-62-2	Vanadium	27.40		
		7440-66-6	Zinc	933.00	J	

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-1-0	MB5B21	7429-90-5	Aluminum	7000.00		
		7440-36-0	Antimony	0.09	BJ	
		7440-38-2	Arsenic	3.74		
		7440-39-3	Barium	81.00		
		7440-41-7	Beryllium	0.53		
		7440-43-9	Cadmium	0.29	J	
		7440-70-2	Calcium	43200.00		
		7440-47-3	Chromium	41.5	J	
		7440-48-4	Cobalt	9.75		
		7440-50-8	Copper	33.60		
		7439-89-6	Iron	15300.00	J	
		7439-92-1	Lead	1008.00		>SSL
		7439-95-4	Magnesium	16400.00		
		7439-96-5	Manganese	323.00		
		7439-97-6	Mercury	0.12	J	
		7440-02-0	Nickel	130.00	J	
		7440-09-7	Potassium	1301.00		
		7782-49-2	Selenium	0.28	BJ	
		7440-22-4	Silver	0.12	BJ	
		7440-23-5	Sodium	432.00	BJ	
		7440-28-0	Thallium	0.21	BJ	
		7440-62-2	Vanadium	22.40		
		7440-66-6	Zinc	96.90		
A-1-1	MB5B22	7429-90-5	Aluminum	9290.00		
		7440-36-0	Antimony	1.92	BJ	
		7440-38-2	Arsenic	7.35		
		7440-39-3	Barium	285.00		
		7440-41-7	Beryllium	0.42	BJ	
		7440-43-9	Cadmium	1.08		
		7440-70-2	Calcium	5220.00		
		7440-47-3	Chromium	28.40	J	
		7440-48-4	Cobalt	7.55		
		7440-50-8	Copper	70.80		
		7439-89-6	Iron	14500.00		
		7439-92-1	Lead	47700.00		>SSL & BG
		7439-95-4	Magnesium	18100.00		
		7439-96-5	Manganese	899.00		
		7439-97-6	Mercury	0.52	J	
		7440-02-0	Nickel	58.00	J	
		7440-09-7	Potassium	1005.00		
		7782-49-2	Selenium	1.36	BJ	
		7440-22-4	Silver	0.68	BR	
		7440-23-5	Sodium	516.00		
		7440-28-0	Thallium	0.40	BJ	
		7440-62-2	Vanadium	24.10		
		7440-66-6	Zinc	183.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-1-2	MB5B23	7429-90-5	Aluminum	8560.00		
		7440-36-0	Antimony	1.66	BJ	
		7440-38-2	Arsenic	15.00		
		7440-39-3	Barium	260.00		
		7440-41-7	Beryllium	0.41	BJ	
		7440-43-9	Cadmium	0.78		
		7440-70-2	Calcium	32500.00		
		7440-47-3	Chromium	33.00	J	
		7440-48-4	Cobalt	9.08		
		7440-50-8	Copper	91.60		
		7439-89-6	Iron	17500.00		
		7439-92-1	Lead	17600.00		>SSL & BG
		7439-95-4	Magnesium	11400.00		
		7439-96-5	Manganese	841.00		
		7439-97-6	Mercury	0.34	J	
		7440-02-0	Nickel	78.80	J	
		7440-09-7	Potassium	973.00		
		7782-49-2	Selenium	0.85	BJ	
		7440-22-4	Silver	0.56	BR	
		7440-23-5	Sodium	311.00	B	
		7440-28-0	Thallium	0.27	BJ	
		7440-62-2	Vanadium	26.20		
		7440-66-6	Zinc	179.00		
A-1-3	MB5B24	7429-90-5	Aluminum	11100.00		
		7440-36-0	Antimony	0.01	UJ	
		7440-38-2	Arsenic	9.37		
		7440-39-3	Barium	36.50		
		7440-41-7	Beryllium	0.69	J	
		7440-43-9	Cadmium	0.03		
		7440-70-2	Calcium	2620.00		
		7440-47-3	Chromium	26.00	J	
		7440-48-4	Cobalt	5.18		
		7440-50-8	Copper	13.10		
		7439-89-6	Iron	24900.00		
		7439-92-1	Lead	42.90		
		7439-95-4	Magnesium	2110.00		
		7439-96-5	Manganese	187.00		
		7439-97-6	Mercury	0.08	J	
		7440-02-0	Nickel	12.90	J	
		7440-09-7	Potassium	1760.00		
		7782-49-2	Selenium	0.17	BJ	
		7440-22-4	Silver	0.02	BJ	
		7440-23-5	Sodium	208.00	B	
		7440-28-0	Thallium	0.17	BJ	
		7440-62-2	Vanadium	40.90		
		7440-66-6	Zinc	45.70		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-2-0	MB5B25	7429-90-5	Aluminum	10100.00		
		7440-36-0	Antimony	1.85	BJ	
		7440-38-2	Arsenic	7.15		
		7440-39-3	Barium	591.00		
		7440-41-7	Beryllium	3.13		
		7440-43-9	Cadmium	0.90	J	
		7440-70-2	Calcium	80200.00		
		7440-47-3	Chromium	12.90	J	
		7440-48-4	Cobalt	4.96	J	
		7440-50-8	Copper	86.50		
		7439-89-6	Iron	11700.00	J	
		7439-92-1	Lead	37100.00		>SSL & BG
		7439-95-4	Magnesium	16040.00		
		7439-96-5	Manganese	11900.00		
		7439-97-6	Mercury	0.39	J	
		7440-02-0	Nickel	110.00	J	
		7440-09-7	Potassium	996.00		
		7782-49-2	Selenium	0.95	BJ	
		7440-22-4	Silver	0.85	BJ	
		7440-23-5	Sodium	583.00	J	
		7440-28-0	Thallium	0.29	BJ	
		7440-62-2	Vanadium	14.30		
		7440-66-6	Zinc	122.00		
A-2-1	MB5B26	7429-90-5	Aluminum	6250.00		
		7440-36-0	Antimony	2.68	BJ	
		7440-38-2	Arsenic	5.67		
		7440-39-3	Barium	540.00		
		7440-41-7	Beryllium	0.28	BJ	
		7440-43-9	Cadmium	1.50		
		7440-70-2	Calcium	62500.00		
		7440-47-3	Chromium	12.50	J	
		7440-48-4	Cobalt	5.55		
		7440-50-8	Copper	92.40		
		7439-89-6	Iron	11700.00		
		7439-92-1	Lead	55500.00		>SSL & BG
		7439-95-4	Magnesium	15020.00		
		7439-96-5	Manganese	1030.00		
		7439-97-6	Mercury	0.34	J	
		7440-02-0	Nickel	34.50	J	
		7440-09-7	Potassium	678.00		
		7782-49-2	Selenium	1.24	BJ	
		7440-22-4	Silver	1.04	J	
		7440-23-5	Sodium	384.00	B	
		7440-28-0	Thallium	0.24	BJ	
		7440-62-2	Vanadium	17.60		
		7440-66-6	Zinc	140.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-2-2	MB5B27	7429-90-5	Aluminum	3410.00	J	
		7440-36-0	Antimony	5.51	BJ	
		7440-38-2	Arsenic	3.87	J	
		7440-39-3	Barium	1170.00	J	
		7440-41-7	Beryllium	0.04	B	
		7440-43-9	Cadmium	4.61	J	
		7440-70-2	Calcium	226000.00	J	
		7440-47-3	Chromium	17.30	J	
		7440-48-4	Cobalt	4.35	J	
		7440-50-8	Copper	135.00	J	
		7439-89-6	Iron	7210.00	J	
		7439-92-1	Lead	130000.00	J	>SSL & BG
		7439-95-4	Magnesium	4940.00	J	
		7439-96-5	Manganese	6250.00	J	
		7439-97-6	Mercury	1.15	J	
		7440-02-0	Nickel	35.30	J	
		7440-09-7	Potassium	482.00	J	
		7782-49-2	Selenium	1.55	BJ	
		7440-22-4	Silver	3.02	J	
		7440-23-5	Sodium	591.00	J	
		7440-28-0	Thallium	0.37	BJ	
		7440-62-2	Vanadium	4.93	J	
		7440-66-6	Zinc	247.00	J	
A-2-3	MB5B28	7429-90-5	Aluminum	4190.00	J	
		7440-36-0	Antimony	7.68	J	
		7440-38-2	Arsenic	2.81	J	
		7440-39-3	Barium	1220.00	J	
		7440-41-7	Beryllium	0.11	BJ	
		7440-43-9	Cadmium	4.77	J	
		7440-70-2	Calcium	213000.00	J	
		7440-47-3	Chromium	13.50	J	
		7440-48-4	Cobalt	5.12	J	
		7440-50-8	Copper	87.00	J	
		7439-89-6	Iron	7760.00	J	
		7439-92-1	Lead	98700.00	J	>SSL & BG
		7439-95-4	Magnesium	3830.00	J	
		7439-96-5	Manganese	3980.00	J	
		7439-97-6	Mercury	1.67	J	
		7440-02-0	Nickel	42.40	J	
		7440-09-7	Potassium	681.00	J	
		7782-49-2	Selenium	1.14	BJ	
		7440-22-4	Silver	2.21	J	
		7440-23-5	Sodium	717.00	J	
		7440-28-0	Thallium	0.49	BJ	
		7440-62-2	Vanadium	8.58	J	
		7440-66-6	Zinc	307.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-3-0	MB5B29	7429-90-5	Aluminum	6460.00		
		7440-36-0	Antimony	0.12	BJ	
		7440-38-2	Arsenic	3.10		
		7440-39-3	Barium	81.90		
		7440-41-7	Beryllium	0.90	B	
		7440-43-9	Cadmium	0.30	BJ	
		7440-70-2	Calcium	8660.00		
		7440-47-3	Chromium	47.60	J	
		7440-48-4	Cobalt	11.80	J	
		7440-50-8	Copper	53.00		
		7439-89-6	Iron	14900.00	J	
		7439-92-1	Lead	734.00		>SSL
		7439-95-4	Magnesium	9090.00		
		7439-96-5	Manganese	342.00		
		7439-97-6	Mercury	0.09	J	
		7440-02-0	Nickel	143.00	J	
		7440-09-7	Potassium	1060.00		
		7782-49-2	Selenium	0.11	BJ	
		7440-22-4	Silver	0.12	BJ	
		7440-23-5	Sodium	356.00	BJ	
		7440-28-0	Thallium	0.20	BJ	
		7440-62-2	Vanadium	17.50		
		7440-66-6	Zinc	143.00		
A-3-1	MB5B30	7429-90-5	Aluminum	12900.00		
		7440-36-0	Antimony	0.24	BJ	
		7440-38-2	Arsenic	6.35		
		7440-39-3	Barium	86.40		
		7440-41-7	Beryllium	0.37	BJ	
		7440-43-9	Cadmium	0.17		
		7440-70-2	Calcium	1600.00		
		7440-47-3	Chromium	52.60	J	
		7440-48-4	Cobalt	10.90		
		7440-50-8	Copper	41.90		
		7439-89-6	Iron	21400.00		
		7439-92-1	Lead	80.10		
		7439-95-4	Magnesium	2890.00		
		7439-96-5	Manganese	437.00		
		7439-97-6	Mercury	0.09	J	
		7440-02-0	Nickel	68.30	J	
		7440-09-7	Potassium	1080.00		
		7782-49-2	Selenium	0.59	BJ	
		7440-22-4	Silver	0.28	BJ	
		7440-23-5	Sodium	232.00	B	
		7440-28-0	Thallium	0.19	BJ	
		7440-62-2	Vanadium	30.90		
		7440-66-6	Zinc	59.40		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-3-2	MB5B31	7429-90-5	Aluminum	7404.00		
		7440-36-0	Antimony	0.17	BJ	
		7440-38-2	Arsenic	5.49		
		7440-39-3	Barium	31.20		
		7440-41-7	Beryllium	0.35	BJ	
		7440-43-9	Cadmium	0.18		
		7440-70-2	Calcium	3340.00		
		7440-47-3	Chromium	44.60	J	
		7440-48-4	Cobalt	6.84		
		7440-50-8	Copper	18.70		
		7439-89-6	Iron	13900.00		
		7439-92-1	Lead	541.00		>SSL
		7439-95-4	Magnesium	2440.00		
		7439-96-5	Manganese	166.00		
		7439-97-6	Mercury	0.06	J	
		7440-02-0	Nickel	44.50	J	
		7440-09-7	Potassium	762.00		
		7782-49-2	Selenium	0.23	BJ	
		7440-22-4	Silver	0.02	BJ	
		7440-23-5	Sodium	111.00	B	
		7440-28-0	Thallium	0.10	BJ	
		7440-62-2	Vanadium	18.70		
		7440-66-6	Zinc	68.20		
A-3-3	MB5B32	7429-90-5	Aluminum	7430.00		
		7440-36-0	Antimony	0.01	UJ	
		7440-38-2	Arsenic	4.74		
		7440-39-3	Barium	22.30		
		7440-41-7	Beryllium	0.30	BJ	
		7440-43-9	Cadmium	0.10		
		7440-70-2	Calcium	1018.00		
		7440-47-3	Chromium	41.80	J	
		7440-48-4	Cobalt	5.68		
		7440-50-8	Copper	33.90		
		7439-89-6	Iron	13300.00		
		7439-92-1	Lead	56.50		
		7439-95-4	Magnesium	2370.00		
		7439-96-5	Manganese	127.00		
		7439-97-6	Mercury	0.04	J	
		7440-02-0	Nickel	28.10	J	
		7440-09-7	Potassium	669.00		
		7782-49-2	Selenium	0.09	BJ	
		7440-22-4	Silver	0.01	BJ	
		7440-23-5	Sodium	83.90	B	
		7440-28-0	Thallium	0.07	BJ	
		7440-62-2	Vanadium	15.60		
		7440-66-6	Zinc	58.50		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
G-3-3	MB5B83	7429-90-5	Aluminum	6304.00		
		7440-36-0	Antimony	0.03	B	
		7440-38-2	Arsenic	5.57		
		7440-39-3	Barium	23.50	J	
		7440-41-7	Beryllium	0.40	B	
		7440-43-9	Cadmium	0.13	J	
		7440-70-2	Calcium	1120.00		
		7440-47-3	Chromium	41.50	J	
		7440-48-4	Cobalt	6.28	J	
		7440-50-8	Copper	25.70		
		7439-89-6	Iron	15100.00		
		7439-92-1	Lead	68.90	J	
		7439-95-4	Magnesium	2610.00		
		7439-96-5	Manganese	165.00	J	
		7439-97-6	Mercury	0.08	J	
		7440-02-0	Nickel	49.30	J	
		7440-09-7	Potassium	816.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.07	BJ	
		7440-23-5	Sodium	222.00	BJ	
		7440-28-0	Thallium	0.16	B	
		7440-62-2	Vanadium	17.00		
		7440-66-6	Zinc	57.70	J	
A-4-0	MB5B33	7429-90-5	Aluminum	6900.00		
		7440-36-0	Antimony	0.03	BJ	
		7440-38-2	Arsenic	2.95		
		7440-39-3	Barium	81.20		
		7440-41-7	Beryllium	0.67		
		7440-43-9	Cadmium	0.25	BJ	
		7440-70-2	Calcium	9600.00		
		7440-47-3	Chromium	72.20	J	
		7440-48-4	Cobalt	29.20	J	
		7440-50-8	Copper	35.10		
		7439-89-6	Iron	20800.00	J	
		7439-92-1	Lead	257.00		
		7439-95-4	Magnesium	13100.00		
		7439-96-5	Manganese	520.00		
		7439-97-6	Mercury	0.17	J	
		7440-02-0	Nickel	620.00	J	
		7440-09-7	Potassium	1470.00		
		7782-49-2	Selenium	0.09	BJ	
		7440-22-4	Silver	0.09	BJ	
		7440-23-5	Sodium	796.00	J	
		7440-28-0	Thallium	0.34	BJ	
		7440-62-2	Vanadium	15.80		
		7440-66-6	Zinc	82.20		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-4-1	MB5B34	7429-90-5	Aluminum	7630.00		
		7440-36-0	Antimony	3.42	BJ	
		7440-38-2	Arsenic	6.57		
		7440-39-3	Barium	311.00		
		7440-41-7	Beryllium	0.39	BJ	
		7440-43-9	Cadmium	1.59		
		7440-70-2	Calcium	65100.00		
		7440-47-3	Chromium	53.20	J	
		7440-48-4	Cobalt	5.15		
		7440-50-8	Copper	84.00		
		7439-89-6	Iron	13200.00		
		7439-92-1	Lead	26200.00		>SSL & BG
		7439-95-4	Magnesium	9920.00		
		7439-96-5	Manganese	746.00		
		7439-97-6	Mercury	0.43	J	
		7440-02-0	Nickel	29.20	J	
		7440-09-7	Potassium	901.00		
		7782-49-2	Selenium	0.63	BJ	
		7440-22-4	Silver	0.56	BJ	
		7440-23-5	Sodium	397.00	B	
		7440-28-0	Thallium	0.12	BJ	
		7440-62-2	Vanadium	19.50		
		7440-66-6	Zinc	305.00		
A-4-2	MB5B35	7429-90-5	Aluminum	5870.00		
		7440-36-0	Antimony	3.79	BJ	
		7440-38-2	Arsenic	14.90		
		7440-39-3	Barium	667.00		
		7440-41-7	Beryllium	0.17	BJ	
		7440-43-9	Cadmium	2.45		
		7440-70-2	Calcium	91300.00		
		7440-47-3	Chromium	19.40	J	
		7440-48-4	Cobalt	4.76		
		7440-50-8	Copper	102.00		
		7439-89-6	Iron	9920.00		
		7439-92-1	Lead	62700.00		>SSL & BG
		7439-95-4	Magnesium	5740.00		
		7439-96-5	Manganese	1300.00		
		7439-97-6	Mercury	0.53	J	
		7440-02-0	Nickel	32.00	J	
		7440-09-7	Potassium	763.00		
		7782-49-2	Selenium	0.67	BJ	
		7440-22-4	Silver	1.31	BJ	
		7440-23-5	Sodium	477.00	B	
		7440-28-0	Thallium	0.16	BJ	
		7440-62-2	Vanadium	12.20		
		7440-66-6	Zinc	275.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-4-3	MB5B36	7429-90-5	Aluminum	1820.00		
		7440-36-0	Antimony	5.43	BJ	
		7440-38-2	Arsenic	6.90		
		7440-39-3	Barium	1150.00		
		7440-41-7	Beryllium	0.07	BJ	
		7440-43-9	Cadmium	2.67		
		7440-70-2	Calcium	175000.00		
		7440-47-3	Chromium	12.50	J	
		7440-48-4	Cobalt	2.67		
		7440-50-8	Copper	109.00		
		7439-89-6	Iron	6270.00		
		7439-92-1	Lead	105000.00		>SSL & BG
		7439-95-4	Magnesium	2820.00		
		7439-96-5	Manganese	2290.00		
		7439-97-6	Mercury	0.96	J	
		7440-02-0	Nickel	6.09	J	
		7440-09-7	Potassium	557.00		
		7782-49-2	Selenium	0.80	BJ	
		7440-22-4	Silver	2.05	BJ	
		7440-23-5	Sodium	394.00	B	
		7440-28-0	Thallium	0.53	BJ	
		7440-62-2	Vanadium	2.83		
		7440-66-6	Zinc	142.00		
A-5-0	MB5B37	7429-90-5	Aluminum	7804.00		
		7440-36-0	Antimony	0.54	BJ	
		7440-38-2	Arsenic	9.59		
		7440-39-3	Barium	184.00		
		7440-41-7	Beryllium	0.75		
		7440-43-9	Cadmium	1.11	J	
		7440-70-2	Calcium	44700.00		
		7440-47-3	Chromium	86.60	J	
		7440-48-4	Cobalt	15.60	J	
		7440-50-8	Copper	72.40		
		7439-89-6	Iron	17600.00	J	
		7439-92-1	Lead	8005.00		>SSL & BG
		7439-95-4	Magnesium	11200.00		
		7439-96-5	Manganese	443.00		
		7439-97-6	Mercury	0.59	J	
		7440-02-0	Nickel	248.00	J	
		7440-09-7	Potassium	1220.00		
		7782-49-2	Selenium	0.37	BJ	
		7440-22-4	Silver	0.44	BJ	
		7440-23-5	Sodium	528.00	J	
		7440-28-0	Thallium	0.54	BJ	
		7440-62-2	Vanadium	23.30		
		7440-66-6	Zinc	335.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-5-1	MB5B38	7429-90-5	Aluminum	8830.00		
		7440-36-0	Antimony	4.53	BJ	
		7440-38-2	Arsenic	7.86		
		7440-39-3	Barium	360.00		
		7440-41-7	Beryllium	0.42	BJ	
		7440-43-9	Cadmium	1.73		
		7440-70-2	Calcium	49700.00		
		7440-47-3	Chromium	33.60	J	
		7440-48-4	Cobalt	11.20		
		7440-50-8	Copper	317.00		
		7439-89-6	Iron	17500.00		
		7439-92-1	Lead	28500.00		>SSL & BG
		7439-95-4	Magnesium	8709.00		
		7439-96-5	Manganese	850.00		
		7439-97-6	Mercury	0.53	J	
		7440-02-0	Nickel	72.90	J	
		7440-09-7	Potassium	1038.00		
		7782-49-2	Selenium	0.76	BJ	
		7440-22-4	Silver	0.84	BJ	
		7440-23-5	Sodium	370.00	B	
		7440-28-0	Thallium	0.16	BJ	
		7440-62-2	Vanadium	22.80		
		7440-66-6	Zinc	636.00		
G-5-1	MB5B84	7429-90-5	Aluminum	6830.00		
		7440-36-0	Antimony	5.10	B	
		7440-38-2	Arsenic	7.71		
		7440-39-3	Barium	471.00	J	
		7440-41-7	Beryllium	0.56	B	
		7440-43-9	Cadmium	1.98	J	
		7440-70-2	Calcium	62700.00		
		7440-47-3	Chromium	36.40	J	
		7440-48-4	Cobalt	9.51	J	
		7440-50-8	Copper	330.00		
		7439-89-6	Iron	16100.00		
		7439-92-1	Lead	31400.00	J	>SSL & BG
		7439-95-4	Magnesium	10100.00		
		7439-96-5	Manganese	830.00	J	
		7439-97-6	Mercury	0.66	J	
		7440-02-0	Nickel	119.00	J	
		7440-09-7	Potassium	1160.00	J	
		7782-49-2	Selenium	0.77	UJ	
		7440-22-4	Silver	0.96	BJ	
		7440-23-5	Sodium	628.00	J	
		7440-28-0	Thallium	0.45	B	
		7440-62-2	Vanadium	23.70		
		7440-66-6	Zinc	673.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
A-5-2	MB5B39	7429-90-5	Aluminum	8260.00		
		7440-36-0	Antimony	0.46	BJ	
		7440-38-2	Arsenic	13.40		
		7440-39-3	Barium	390.00		
		7440-41-7	Beryllium	0.60	J	
		7440-43-9	Cadmium	1.17		
		7440-70-2	Calcium	38700.00		
		7440-47-3	Chromium	21.60	J	
		7440-48-4	Cobalt	8.24		
		7440-50-8	Copper	55.90		
		7439-89-6	Iron	17500.00		
		7439-92-1	Lead	3440.00		>SSL & BG
		7439-95-4	Magnesium	4080.00		
		7439-96-5	Manganese	256.00		
		7439-97-6	Mercury	0.35	J	
		7440-02-0	Nickel	26.40	J	
		7440-09-7	Potassium	1050.00		
		7782-49-2	Selenium	0.75	BJ	
		7440-22-4	Silver	0.22	BJ	
		7440-23-5	Sodium	286.00	BJ	
		7440-28-0	Thallium	0.18	BJ	
		7440-62-2	Vanadium	23.80		
		7440-66-6	Zinc	417.00		
A-5-3	MB5B40	7429-90-5	Aluminum	3890.00		
		7440-36-0	Antimony	10.70	J	
		7440-38-2	Arsenic	10.40		
		7440-39-3	Barium	947.00		
		7440-41-7	Beryllium	0.25	BJ	
		7440-43-9	Cadmium	2.43		
		7440-70-2	Calcium	104000.00		
		7440-47-3	Chromium	12.80	J	
		7440-48-4	Cobalt	4.16		
		7440-50-8	Copper	264.00		
		7439-89-6	Iron	15800.00		
		7439-92-1	Lead	90900.00		>SSL & BG
		7439-95-4	Magnesium	3020.00		
		7439-96-5	Manganese	1860.00		
		7439-97-6	Mercury	0.57	J	
		7440-02-0	Nickel	22.20	J	
		7440-09-7	Potassium	699.00		
		7782-49-2	Selenium	1.28	BJ	
		7440-22-4	Silver	1.71	BJ	
		7440-23-5	Sodium	426.00	B	
		7440-28-0	Thallium	0.29	BJ	
		7440-62-2	Vanadium	12.20		
		7440-66-6	Zinc	315.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-1-0	MB5B41	7429-90-5	Aluminum	7020.00		
		7440-36-0	Antimony	0.97	B	
		7440-38-2	Arsenic	7.25		
		7440-39-3	Barium	177.00	J	
		7440-41-7	Beryllium	0.52	B	
		7440-43-9	Cadmium	0.63	J	
		7440-70-2	Calcium	29000.00		
		7440-47-3	Chromium	19.00	J	
		7440-48-4	Cobalt	7.60	J	
		7440-50-8	Copper	75.30		
		7439-89-6	Iron	16500.00		
		7439-92-1	Lead	13400.00	J	>SSL & BG
		7439-95-4	Magnesium	8740.00		
		7439-96-5	Manganese	538.00	J	
		7439-97-6	Mercury	0.27	J	
		7440-02-0	Nickel	37.00	J	
		7440-09-7	Potassium	951.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.50	BJ	
		7440-23-5	Sodium	301.00	BJ	
		7440-28-0	Thallium	0.15	B	
		7440-62-2	Vanadium	25.80	J	
		7440-66-6	Zinc	166.00		
B-1-1	MB5B42	7429-90-5	Aluminum	8270.00		
		7440-36-0	Antimony	0.52	BJ	
		7440-38-2	Arsenic	9.71		
		7440-39-3	Barium	100.00		
		7440-41-7	Beryllium	0.57		
		7440-43-9	Cadmium	0.40		
		7440-70-2	Calcium	13400.00		
		7440-47-3	Chromium	16.30	J	
		7440-48-4	Cobalt	7.53		
		7440-50-8	Copper	59.10		
		7439-89-6	Iron	20400.00		
		7439-92-1	Lead	8390.00		>SSL & BG
		7439-95-4	Magnesium	4710.00		
		7439-96-5	Manganese	420.00		
		7439-97-6	Mercury	0.14	J	
		7440-02-0	Nickel	22.30	J	
		7440-09-7	Potassium	939.00		
		7782-49-2	Selenium	1.39	BJ	
		7440-22-4	Silver	0.28	BR	
		7440-23-5	Sodium	315.00	B	
		7440-28-0	Thallium	0.38	BJ	
		7440-62-2	Vanadium	26.30		
		7440-66-6	Zinc	106.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-1-2	MB5B43	7429-90-5	Aluminum	7410.00		
		7440-36-0	Antimony	2.82	BJ	
		7440-38-2	Arsenic	47.40		
		7440-39-3	Barium	290.00		
		7440-41-7	Beryllium	0.65	J	
		7440-43-9	Cadmium	1.74		
		7440-70-2	Calcium	22900.00		
		7440-47-3	Chromium	30.60	J	
		7440-48-4	Cobalt	11.40		
		7440-50-8	Copper	189.00		
		7439-89-6	Iron	17200.00		
		7439-92-1	Lead	13400.00		>SSL & BG
		7439-95-4	Magnesium	8029.00		
		7439-96-5	Manganese	647.00		
		7439-97-6	Mercury	0.25	J	
		7440-02-0	Nickel	79.40	J	
		7440-09-7	Potassium	855.00		
		7782-49-2	Selenium	1.45	BJ	
		7440-22-4	Silver	0.95	BR	
		7440-23-5	Sodium	441.00	B	
		7440-28-0	Thallium	0.21	BJ	
		7440-62-2	Vanadium	37.60		
		7440-66-6	Zinc	437.00		
B-1-3	MB5B44	7429-90-5	Aluminum	9840.00		
		7440-36-0	Antimony	0.05	UJ	
		7440-38-2	Arsenic	4.95		
		7440-39-3	Barium	60.10		
		7440-41-7	Beryllium	0.70		
		7440-43-9	Cadmium	0.06		
		7440-70-2	Calcium	10300.00		
		7440-47-3	Chromium	30.40	J	
		7440-48-4	Cobalt	7.50		
		7440-50-8	Copper	13.00		
		7439-89-6	Iron	19700.00		
		7439-92-1	Lead	333.00		
		7439-95-4	Magnesium	3220.00		
		7439-96-5	Manganese	280.00		
		7439-97-6	Mercury	0.09	J	
		7440-02-0	Nickel	26.90	J	
		7440-09-7	Potassium	1390.00		
		7782-49-2	Selenium	0.37	BJ	
		7440-22-4	Silver	0.07	BR	
		7440-23-5	Sodium	393.00	B	
		7440-28-0	Thallium	0.13	BJ	
		7440-62-2	Vanadium	36.30		
		7440-66-6	Zinc	43.80		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-2-0	MB5B45	7429-90-5	Aluminum	4960.00		
		7440-36-0	Antimony	0.23	BJ	
		7440-38-2	Arsenic	2.75	J	
		7440-39-3	Barium	52.40	J	
		7440-41-7	Beryllium	0.35	B	
		7440-43-9	Cadmium	0.17	J	
		7440-70-2	Calcium	11500.00		
		7440-47-3	Chromium	24.70	J	
		7440-48-4	Cobalt	7.98	J	
		7440-50-8	Copper	18.60	J	
		7439-89-6	Iron	11600.00		
		7439-92-1	Lead	456.00	J	>SSL
		7439-95-4	Magnesium	5830.00		
		7439-96-5	Manganese	243.00	J	
		7439-97-6	Mercury	0.07	J	
		7440-02-0	Nickel	92.70	J	
		7440-09-7	Potassium	872.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.16	BJ	
		7440-23-5	Sodium	555.00	J	
		7440-28-0	Thallium	0.10	B	
		7440-62-2	Vanadium	15.80	J	
		7440-66-6	Zinc	70.60		
B-2-1	MB5B46	7429-90-5	Aluminum	6370.00		
		7440-36-0	Antimony	0.97	BJ	
		7440-38-2	Arsenic	2.92		
		7440-39-3	Barium	815.00		
		7440-41-7	Beryllium	0.56	J	
		7440-43-9	Cadmium	1.52		
		7440-70-2	Calcium	54000.00		
		7440-47-3	Chromium	108.00	J	
		7440-48-4	Cobalt	74.60		
		7440-50-8	Copper	212.00		
		7439-89-6	Iron	36300.00		
		7439-92-1	Lead	69300.00		>SSL & BG
		7439-95-4	Magnesium	45100.00		
		7439-96-5	Manganese	3370.00		
		7439-97-6	Mercury	1.18	J	
		7440-02-0	Nickel	1220.00	J	
		7440-09-7	Potassium	303.00		
		7782-49-2	Selenium	0.85	BJ	
		7440-22-4	Silver	1.13	BR	
		7440-23-5	Sodium	446.00	B	
		7440-28-0	Thallium	0.20	BJ	
		7440-62-2	Vanadium	13.10		
		7440-66-6	Zinc	184.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-2-2	MB5B47	7429-90-5	Aluminum	2330.00		
		7440-36-0	Antimony	5.53	BJ	
		7440-38-2	Arsenic	5.21		
		7440-39-3	Barium	1570.00		
		7440-41-7	Beryllium	0.15	BJ	
		7440-43-9	Cadmium	3.76		
		7440-70-2	Calcium	141000.00		
		7440-47-3	Chromium	17.70	J	
		7440-48-4	Cobalt	8.18		
		7440-50-8	Copper	261.00		
		7439-89-6	Iron	10050.00		
		7439-92-1	Lead	145000.00		>SSL & BG
		7439-95-4	Magnesium	14900.00		
		7439-96-5	Manganese	3300.00		
		7439-97-6	Mercury	1.35	J	
		7440-02-0	Nickel	118.00	J	
		7440-09-7	Potassium	337.00		
		7782-49-2	Selenium	1.70	BJ	
		7440-22-4	Silver	2.34	BR	
		7440-23-5	Sodium	682.00		
		7440-28-0	Thallium	0.24	BJ	
		7440-62-2	Vanadium	5.58		
G-2-2	MB5B82	7440-66-6	Zinc	191.00		
		7429-90-5	Aluminum	2850.00		
		7440-36-0	Antimony	11.70	B	
		7440-38-2	Arsenic	4.49		
		7440-39-3	Barium	1520.00	J	
		7440-41-7	Beryllium	0.27	B	
		7440-43-9	Cadmium	3.86	J	
		7440-70-2	Calcium	20050.00		
		7440-47-3	Chromium	26.20	J	
		7440-48-4	Cobalt	6.96	J	
		7440-50-8	Copper	154.00		
		7439-89-6	Iron	9570.00		
		7439-92-1	Lead	240000.00	J	>SSL & BG
		7439-95-4	Magnesium	13500.00		
		7439-96-5	Manganese	3080.00	J	
		7439-97-6	Mercury	1.16	J	
		7440-02-0	Nickel	196.00	J	
		7440-09-7	Potassium	568.00	J	
		7782-49-2	Selenium	0.62	BJ	
		7440-22-4	Silver	7.83	J	
		7440-23-5	Sodium	1160.00	J	
		7440-28-0	Thallium	0.61	B	
		7440-62-2	Vanadium	6.85		
		7440-66-6	Zinc	244.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-2-3	MB5B48	7429-90-5	Aluminum	2020.00	J	
		7440-36-0	Antimony	5.47	BJ	
		7440-38-2	Arsenic	3.48	J	
		7440-39-3	Barium	1250.00	J	
		7440-41-7	Beryllium	0.26	BJ	
		7440-43-9	Cadmium	4.18	J	
		7440-70-2	Calcium	227000.00	J	
		7440-47-3	Chromium	20.40	J	
		7440-48-4	Cobalt	4660.00	J	
		7440-50-8	Copper	127.00	J	
		7439-89-6	Iron	6790.00	J	
		7439-92-1	Lead	160000.00	J	>SSL & BG
		7439-95-4	Magnesium	9960.00	J	
		7439-96-5	Manganese	4380.00	J	
		7439-97-6	Mercury	1.18	J	
		7440-02-0	Nickel	91.60	J	
		7440-09-7	Potassium	276.00	J	
		7782-49-2	Selenium	0.89	BJ	
		7440-22-4	Silver	3.83	BJ	
		7440-23-5	Sodium	739.00	J	
		7440-28-0	Thallium	0.62	BJ	
		7440-62-2	Vanadium	4.53	J	
		7440-66-6	Zinc	206.00	J	
B-3-0	MB5B49	7429-90-5	Aluminum	4980.00		
		7440-36-0	Antimony	0.41	BJ	
		7440-38-2	Arsenic	3.47	J	
		7440-39-3	Barium	66.40	J	
		7440-41-7	Beryllium	0.55	B	
		7440-43-9	Cadmium	0.24	J	
		7440-70-2	Calcium	7320.00		
		7440-47-3	Chromium	18.60	J	
		7440-48-4	Cobalt	6.97	J	
		7440-50-8	Copper	27.30	J	
		7439-89-6	Iron	11900.00		
		7439-92-1	Lead	319.00	J	
		7439-95-4	Magnesium	4204.00		
		7439-96-5	Manganese	253.00	J	
		7439-97-6	Mercury	0.07	J	
		7440-02-0	Nickel	52.50	J	
		7440-09-7	Potassium	1005.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.21	BJ	
		7440-23-5	Sodium	404.00	BJ	
		7440-28-0	Thallium	0.11	B	
		7440-62-2	Vanadium	19.30	J	
		7440-66-6	Zinc	102.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-3-1	MB5B50	7429-90-5	Aluminum	7110.00	J	
		7440-36-0	Antimony	1.07	BJ	
		7440-38-2	Arsenic	6.80	J	
		7440-39-3	Barium	207.00		
		7440-41-7	Beryllium	0.50	BJ	
		7440-43-9	Cadmium	1.20	J	
		7440-70-2	Calcium	53080.00		
		7440-47-3	Chromium	26.20		
		7440-48-4	Cobalt	7.88		
		7440-50-8	Copper	80.40		
		7439-89-6	Iron	13600.00		
		7439-92-1	Lead	10300.00	J	>SSL & BG
		7439-95-4	Magnesium	17600.00		
		7439-96-5	Manganese	448.00	J	
		7439-97-6	Mercury	0.65		
		7440-02-0	Nickel	113.00	J	
		7440-09-7	Potassium	873.00		
		7782-49-2	Selenium	0.72	B	
		7440-22-4	Silver	0.46	BJ	
		7440-23-5	Sodium	430.00	BJ	
		7440-28-0	Thallium	0.22	BJ	
		7440-62-2	Vanadium	20.20	J	
		7440-66-6	Zinc	322.00	J	
B-3-2	MB5B51	7429-90-5	Aluminum	4740.00	J	
		7440-36-0	Antimony	6.24	BJ	
		7440-38-2	Arsenic	6.79	J	
		7440-39-3	Barium	1480.00		
		7440-41-7	Beryllium	0.52	J	
		7440-43-9	Cadmium	3.71	J	
		7440-70-2	Calcium	150000.00		
		7440-47-3	Chromium	28.60		
		7440-48-4	Cobalt	16.00		
		7440-50-8	Copper	160.00	J	
		7439-89-6	Iron	16400.00		
		7439-92-1	Lead	123000.00	J	>SSL & BG
		7439-95-4	Magnesium	13600.00		
		7439-96-5	Manganese	4020.00	J	
		7439-97-6	Mercury	0.84		
		7440-02-0	Nickel	490.00	J	
		7440-09-7	Potassium	589.00		
		7782-49-2	Selenium	1.37	B	
		7440-22-4	Silver	4.17	BJ	
		7440-23-5	Sodium	690.00	J	
		7440-28-0	Thallium	0.60	BJ	
		7440-62-2	Vanadium	11.80	J	
		7440-66-6	Zinc	243.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-3-3	MB5B52	7429-90-5	Aluminum	5470.00	J	
		7440-36-0	Antimony	7.00	J	
		7440-38-2	Arsenic	15.00	J	
		7440-39-3	Barium	1280.00		
		7440-41-7	Beryllium	1.16	J	
		7440-43-9	Cadmium	2.76	J	
		7440-70-2	Calcium	171000.00		
		7440-47-3	Chromium	22.80		
		7440-48-4	Cobalt	6.48		
		7440-50-8	Copper	245.00	J	
		7439-89-6	Iron	11900.00		
		7439-92-1	Lead	100700.00	J	>SSL & BG
		7439-95-4	Magnesium	6090.00		
		7439-96-5	Manganese	7900.00	J	
		7439-97-6	Mercury	1.42		
		7440-02-0	Nickel	302.00	J	
		7440-09-7	Potassium	735.00		
		7782-49-2	Selenium	2.02	B	
		7440-22-4	Silver	3.03	BJ	
		7440-23-5	Sodium	921.00	J	
		7440-28-0	Thallium	0.31	BJ	
		7440-62-2	Vanadium	7.71	J	
		7440-66-6	Zinc	180.00	J	
B-4-0	MB5B53	7429-90-5	Aluminum	13500.00		
		7440-36-0	Antimony	0.36	BJ	
		7440-38-2	Arsenic	3.97	J	
		7440-39-3	Barium	70.40	J	
		7440-41-7	Beryllium	0.60	B	
		7440-43-9	Cadmium	0.27	J	
		7440-70-2	Calcium	15200.00		
		7440-47-3	Chromium	59.20	J	
		7440-48-4	Cobalt	23.30	J	
		7440-50-8	Copper	32.40	J	
		7439-89-6	Iron	17200.00		
		7439-92-1	Lead	538.00	J	>SSL
		7439-95-4	Magnesium	13500.00		
		7439-96-5	Manganese	347.00	J	
		7439-97-6	Mercury	0.08	J	
		7440-02-0	Nickel	317.00	J	
		7440-09-7	Potassium	1550.00	J	
		7782-49-2	Selenium	0.11	UJ	
		7440-22-4	Silver	0.21	BJ	
		7440-23-5	Sodium	3401.00	J	
		7440-28-0	Thallium	0.17	B	
		7440-62-2	Vanadium	24.10	J	
		7440-66-6	Zinc	101.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-4-1	MB5B54	7429-90-5	Aluminum	7042.00	J	
		7440-36-0	Antimony	1.37	BJ	
		7440-38-2	Arsenic	5.31	J	
		7440-39-3	Barium	236.00		
		7440-41-7	Beryllium	0.45	BJ	
		7440-43-9	Cadmium	1.41	J	
		7440-70-2	Calcium	49900.00		
		7440-47-3	Chromium	15.20		
		7440-48-4	Cobalt	5.61		
		7440-50-8	Copper	94.60	J	
		7439-89-6	Iron	12500.00		
		7439-92-1	Lead	17300.00	J	>SSL & BG
		7439-95-4	Magnesium	8940.00		
		7439-96-5	Manganese	505.00	J	
		7439-97-6	Mercury	0.46		
		7440-02-0	Nickel	43.90	J	
		7440-09-7	Potassium	1980.00		
		7782-49-2	Selenium	0.23	B	
		7440-22-4	Silver	0.56	BJ	
		7440-23-5	Sodium	410.00	BJ	
		7440-28-0	Thallium	0.13	BJ	
		7440-62-2	Vanadium	18.90	J	
		7440-66-6	Zinc	376.00	J	
B-4-2	MB5B55	7429-90-5	Aluminum	7550.00	J	
		7440-36-0	Antimony	0.77	BJ	
		7440-38-2	Arsenic	6.27	J	
		7440-39-3	Barium	181.00		
		7440-41-7	Beryllium	0.51	J	
		7440-43-9	Cadmium	2.25	J	
		7440-70-2	Calcium	81100.00		
		7440-47-3	Chromium	22.40		
		7440-48-4	Cobalt	5.46		
		7440-50-8	Copper	118.00	J	
		7439-89-6	Iron	12700.00		
		7439-92-1	Lead	8870.00	J	>SSL & BG
		7439-95-4	Magnesium	8840.00		
		7439-96-5	Manganese	365.00	J	
		7439-97-6	Mercury	0.55		
		7440-02-0	Nickel	41.50	J	
		7440-09-7	Potassium	1020.00		
		7782-49-2	Selenium	0.20	B	
		7440-22-4	Silver	0.33	BJ	
		7440-23-5	Sodium	440.00	BJ	
		7440-28-0	Thallium	0.11	BJ	
		7440-62-2	Vanadium	21.20	J	
		7440-66-6	Zinc	560.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
B-4-3	MB5B56	7429-90-5	Aluminum	6880.00	J	
		7440-36-0	Antimony	1.09	BJ	
		7440-38-2	Arsenic	4.69	J	
		7440-39-3	Barium	236.00		
		7440-41-7	Beryllium	0.40	BJ	
		7440-43-9	Cadmium	1.82	J	
		7440-70-2	Calcium	75500.00		
		7440-47-3	Chromium	35.00		
		7440-48-4	Cobalt	5.10		
		7440-50-8	Copper	94.00	J	
		7439-89-6	Iron	13600.00		
		7439-92-1	Lead	18400.00	J	>SSL & BG
		7439-95-4	Magnesium	5820.00		
		7439-96-5	Manganese	503.00	J	
		7439-97-6	Mercury	0.67		
		7440-02-0	Nickel	57.60	J	
		7440-09-7	Potassium	1150.00		
		7782-49-2	Selenium	1.13	B	
		7440-22-4	Silver	0.48	BJ	
		7440-23-5	Sodium	575.00	J	
		7440-28-0	Thallium	0.49	BJ	
		7440-62-2	Vanadium	19.00	J	
		7440-66-6	Zinc	408.00	J	
C-1-0	MB5B57	7429-90-5	Aluminum	6200.00		
		7440-36-0	Antimony	1.50	BJ	
		7440-38-2	Arsenic	6.83	J	
		7440-39-3	Barium	171.00	J	
		7440-41-7	Beryllium	0.38	B	
		7440-43-9	Cadmium	0.80	J	
		7440-70-2	Calcium	28100.00		
		7440-47-3	Chromium	15.80	J	
		7440-48-4	Cobalt	6.55	J	
		7440-50-8	Copper	148.00	J	
		7439-89-6	Iron	14000.00		
		7439-92-1	Lead	11500.00	J	>SSL & BG
		7439-95-4	Magnesium	7060.00		
		7439-96-5	Manganese	435.00	J	
		7439-97-6	Mercury	0.22	J	
		7440-02-0	Nickel	32.00	J	
		7440-09-7	Potassium	864.00	J	
		7782-49-2	Selenium	0.02	UJ	
		7440-22-4	Silver	0.55	BJ	
		7440-23-5	Sodium	387.00	BJ	
		7440-28-0	Thallium	0.15	B	
		7440-62-2	Vanadium	21.20	J	
		7440-66-6	Zinc	282.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-1-1	MB5B58	7429-90-5	Aluminum	5670.00	J	
		7440-36-0	Antimony	2.31	BJ	
		7440-38-2	Arsenic	9.55	J	
		7440-39-3	Barium	205.00		
		7440-41-7	Beryllium	0.42	BJ	
		7440-43-9	Cadmium	0.84	J	
		7440-70-2	Calcium	66200.00		
		7440-47-3	Chromium	14.40		
		7440-48-4	Cobalt	7.17		
		7440-50-8	Copper	146.00	J	
		7439-89-6	Iron	14600.00		
		7439-92-1	Lead	12500.00	J	>SSL & BG
		7439-95-4	Magnesium	30900.00		
		7439-96-5	Manganese	498.00	J	
		7439-97-6	Mercury	0.24		
		7440-02-0	Nickel	55.34	J	
		7440-09-7	Potassium	650.00		
		7782-49-2	Selenium	0.41	B	
		7440-22-4	Silver	0.50	BJ	
		7440-23-5	Sodium	293.00	BJ	
		7440-28-0	Thallium	0.15	BJ	
		7440-62-2	Vanadium	20.70	J	
		7440-66-6	Zinc	234.00	J	
C-1-2	MB5B59	7429-90-5	Aluminum	8050.00	J	
		7440-36-0	Antimony	7.15	J	
		7440-38-2	Arsenic	9.54	J	
		7440-39-3	Barium	457.00		
		7440-41-7	Beryllium	0.58	J	
		7440-43-9	Cadmium	1.93	J	
		7440-70-2	Calcium	43600.00		
		7440-47-3	Chromium	21.10		
		7440-48-4	Cobalt	7.18		
		7440-50-8	Copper	1480.00	J	
		7439-89-6	Iron	28900.00		
		7439-92-1	Lead	31300.00	J	>SSL & BG
		7439-95-4	Magnesium	4130.00		
		7439-96-5	Manganese	847.00	J	
		7439-97-6	Mercury	0.31		
		7440-02-0	Nickel	43.10	J	
		7440-09-7	Potassium	780.00		
		7782-49-2	Selenium	0.73	B	
		7440-22-4	Silver	0.98	BJ	
		7440-23-5	Sodium	278.00	BJ	
		7440-28-0	Thallium	0.20	BJ	
		7440-62-2	Vanadium	25.90	J	
		7440-66-6	Zinc	3200.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-1-3	MB5B60	7429-90-5	Aluminum	9880.00	J	
		7440-36-0	Antimony	9.44	J	
		7440-38-2	Arsenic	6.04	J	
		7440-39-3	Barium	527.00		
		7440-41-7	Beryllium	0.70	J	
		7440-43-9	Cadmium	1.77	J	
		7440-70-2	Calcium	40100.00		
		7440-47-3	Chromium	17.40		
		7440-48-4	Cobalt	8.39		
		7440-50-8	Copper	981.00	J	
		7439-89-6	Iron	22600.00		
		7439-92-1	Lead	38000.00	J	>SSL & BG
		7439-95-4	Magnesium	4290.00		
		7439-96-5	Manganese	946.00	J	
		7439-97-6	Mercury	0.26		
		7440-02-0	Nickel	53.30	J	
		7440-09-7	Potassium	1038.00		
		7782-49-2	Selenium	0.70	B	
		7440-22-4	Silver	1.04	BJ	
		7440-23-5	Sodium	314.00	BJ	
		7440-28-0	Thallium	0.20	BJ	
		7440-62-2	Vanadium	23.60	J	
		7440-66-6	Zinc	2090.00	J	
C-2-0	MB5B61	7429-90-5	Aluminum	4280.00		
		7440-36-0	Antimony	0.05	BJ	
		7440-38-2	Arsenic	1.95	J	
		7440-39-3	Barium	45.90	J	
		7440-41-7	Beryllium	0.37	B	
		7440-43-9	Cadmium	0.15	J	
		7440-70-2	Calcium	3850.00		
		7440-47-3	Chromium	15.60	J	
		7440-48-4	Cobalt	7.32	J	
		7440-50-8	Copper	15.80	J	
		7439-89-6	Iron	9960.00		
		7439-92-1	Lead	227.00	J	
		7439-95-4	Magnesium	3500.00		
		7439-96-5	Manganese	268.00	J	
		7439-97-6	Mercury	0.05	J	
		7440-02-0	Nickel	71.60	J	
		7440-09-7	Potassium	822.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.13	BJ	
		7440-23-5	Sodium	352.00	BJ	
		7440-28-0	Thallium	0.10	B	
		7440-62-2	Vanadium	13.90	J	
		7440-66-6	Zinc	58.10		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-2-1	MB5B62	7429-90-5	Aluminum	3230.00	J	
		7440-36-0	Antimony	13.30	J	
		7440-38-2	Arsenic	8.69	J	
		7440-39-3	Barium	1610.00	J	
		7440-41-7	Beryllium	0.42	B	
		7440-43-9	Cadmium	4.80	J	
		7440-70-2	Calcium	18800.00	J	
		7440-47-3	Chromium	19.20	J	
		7440-48-4	Cobalt	5.06	J	
		7440-50-8	Copper	1130.00	J	
		7439-89-6	Iron	17300.00	J	
		7439-92-1	Lead	148000.00	J	>SSL & BG
		7439-95-4	Magnesium	5020.00	J	
		7439-96-5	Manganese	3720.00	J	
		7439-97-6	Mercury	0.79	J	
		7440-02-0	Nickel	86.60	J	
		7440-09-7	Potassium	516.00	J	
		7782-49-2	Selenium	1.12	BJ	
		7440-22-4	Silver	7.74	BJ	
		7440-23-5	Sodium	823.00	J	
		7440-28-0	Thallium	0.44	BJ	
		7440-62-2	Vanadium	10.50	J	
		7440-66-6	Zinc	227.00	J	
C-2-2	MB5B63	7429-90-5	Aluminum	1880.00	J	
		7440-36-0	Antimony	8.47	J	
		7440-38-2	Arsenic	5.72	J	
		7440-39-3	Barium	1550.00		
		7440-41-7	Beryllium	0.25	BJ	
		7440-43-9	Cadmium	5.46	J	
		7440-70-2	Calcium	192000.00		
		7440-47-3	Chromium	21.50		
		7440-48-4	Cobalt	4.42		
		7440-50-8	Copper	145.00	J	
		7439-89-6	Iron	7600.00		
		7439-92-1	Lead	136000.00	J	>SSL & BG
		7439-95-4	Magnesium	2960.00		
		7439-96-5	Manganese	4120.00	J	
		7439-97-6	Mercury	0.42		
		7440-02-0	Nickel	188.00	J	
		7440-09-7	Potassium	332.00		
		7782-49-2	Selenium	0.78	B	
		7440-22-4	Silver	4.54	BJ	
		7440-23-5	Sodium	618.00	J	
		7440-28-0	Thallium	062	BJ	
		7440-62-2	Vanadium	3.78	J	
		7440-66-6	Zinc	230.00	J	

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-2-3	MB5B64	7429-90-5	Aluminum	1809.00	J	
		7440-36-0	Antimony	9.08	J	
		7440-38-2	Arsenic	5.90	J	
		7440-39-3	Barium	1580.00	J	
		7440-41-7	Beryllium	0.26	BJ	
		7440-43-9	Cadmium	5.21	J	
		7440-70-2	Calcium	282000.00	J	
		7440-47-3	Chromium	13.90	J	
		7440-48-4	Cobalt	3.87	J	
		7440-50-8	Copper	153.00	J	
		7439-89-6	Iron	6300.00	J	
		7439-92-1	Lead	134000.00	J	>SSL & BG
		7439-95-4	Magnesium	4180.00	J	
		7439-96-5	Manganese	4660.00	J	
		7439-97-6	Mercury	0.84	J	
		7440-02-0	Nickel	54.60	J	
		7440-09-7	Potassium	437.00	J	
		7782-49-2	Selenium	0.79	BJ	
		7440-22-4	Silver	4.51	BJ	
		7440-23-5	Sodium	837.00	J	
		7440-28-0	Thallium	0.75	BJ	
		7440-62-2	Vanadium	3.93	J	
		7440-66-6	Zinc	206.00	J	
C-3-0	MB5B65	7429-90-5	Aluminum	4770.00		
		7440-36-0	Antimony	0.20	B	
		7440-38-2	Arsenic	2.70		
		7440-39-3	Barium	84.50	J	
		7440-41-7	Beryllium	0.34	B	
		7440-43-9	Cadmium	1.83	J	
		7440-70-2	Calcium	6940.00		
		7440-47-3	Chromium	23.20	J	
		7440-48-4	Cobalt	8.38	J	
		7440-50-8	Copper	22.60		
		7439-89-6	Iron	12100.00		
		7439-92-1	Lead	471.00	J	>SSL
		7439-95-4	Magnesium	7240.00		
		7439-96-5	Manganese	228.00	J	
		7439-97-6	Mercury	0.12	J	
		7440-02-0	Nickel	99.80	J	
		7440-09-7	Potassium	1160.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.17	BJ	
		7440-23-5	Sodium	504.00	J	
		7440-28-0	Thallium	0.10	B	
		7440-62-2	Vanadium	16.45		
		7440-66-6	Zinc	94.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-3-1	MB5B66	7429-90-5	Aluminum	7980.00	J	
		7440-36-0	Antimony	0.95	BJ	
		7440-38-2	Arsenic	33.40	J	
		7440-39-3	Barium	230.00		
		7440-41-7	Beryllium	0.66	J	
		7440-43-9	Cadmium	1.17	J	
		7440-70-2	Calcium	6280.00		
		7440-47-3	Chromium	14.70		
		7440-48-4	Cobalt	5.29		
		7440-50-8	Copper	64.29	J	
		7439-89-6	Iron	10060.00		
		7439-92-1	Lead	12800.00	J	>SSL & BG
		7439-95-4	Magnesium	8400.00		
		7439-96-5	Manganese	423.00	J	
		7439-97-6	Mercury	0.33		
		7440-02-0	Nickel	31.50	J	
		7440-09-7	Potassium	1390.00		
		7782-49-2	Selenium	0.92	B	
		7440-22-4	Silver	0.52	BJ	
		7440-23-5	Sodium	444.00	BJ	
C-3-2	MB5B67	7440-28-0	Thallium	0.23	BJ	
		7440-62-2	Vanadium	26.00	J	
		7440-66-6	Zinc	257.00	J	
		7429-90-5	Aluminum	10800.00	J	
		7440-36-0	Antimony	1.65	BJ	
		7440-38-2	Arsenic	4.96	J	
		7440-39-3	Barium	1380.00	J	
		7440-41-7	Beryllium	0.95	J	
		7440-43-9	Cadmium	2.58	J	
		7440-70-2	Calcium	91600.00	J	
		7440-47-3	Chromium	184.00	J	
		7440-48-4	Cobalt	127.00	J	
		7440-50-8	Copper	360.00	J	
		7439-89-6	Iron	61600.00	J	
		7439-92-1	Lead	118000.00	J	>SSL & BG
		7439-95-4	Magnesium	76600.00	J	
		7439-96-5	Manganese	5720.00	J	
		7439-97-6	Mercury	2.00	J	
		7440-02-0	Nickel	2070.00	J	
		7440-09-7	Potassium	514.00	J	
		7782-49-2	Selenium	1.45	BJ	
		7440-22-4	Silver	1.92	BJ	
		7440-23-5	Sodium	757.00	J	
		7440-28-0	Thallium	0.35	BJ	
		7440-62-2	Vanadium	22.20	J	
		7440-66-6	Zinc	312.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
C-3-3	MB5B68	7429-90-5	Aluminum	1801.00	J	
		7440-36-0	Antimony	8.42	J	
		7440-38-2	Arsenic	6.26	J	
		7440-39-3	Barium	1690.00	J	
		7440-41-7	Beryllium	0.27	BJ	
		7440-43-9	Cadmium	4.50	J	
		7440-70-2	Calcium	24600.00	J	
		7440-47-3	Chromium	17.50	J	
		7440-48-4	Cobalt	3.69	J	
		7440-50-8	Copper	140.00	J	
		7439-89-6	Iron	6720.00	J	
		7439-92-1	Lead	147000.00	J	>SSL & BG
		7439-95-4	Magnesium	3800.00	J	
		7439-96-5	Manganese	3760.00	J	
		7439-97-6	Mercury	0.53	J	
		7440-02-0	Nickel	57.10	J	
		7440-09-7	Potassium	740.00	J	
		7782-49-2	Selenium	1.10	BJ	
		7440-22-4	Silver	3.27	BJ	
		7440-23-5	Sodium	727.00	J	
		7440-28-0	Thallium	0.77	BJ	
		7440-62-2	Vanadium	3.97	J	
		7440-66-6	Zinc	196.00	J	
D-1-0	MB5B69	7429-90-5	Aluminum	6320.00		
		7440-36-0	Antimony	1.47	BJ	
		7440-38-2	Arsenic	6.88	J	
		7440-39-3	Barium	205.00	J	
		7440-41-7	Beryllium	0.37	B	
		7440-43-9	Cadmium	1.06	J	
		7440-70-2	Calcium	34000.00		
		7440-47-3	Chromium	17.50	J	
		7440-48-4	Cobalt	6.88	J	
		7440-50-8	Copper	123.00	J	
		7439-89-6	Iron	15400.00		
		7439-92-1	Lead	6580.00	J	>SSL & BG
		7439-95-4	Magnesium	10700.00		
		7439-96-5	Manganese	376.00	J	
		7439-97-6	Mercury	0.35	J	
		7440-02-0	Nickel	33.50	J	
		7440-09-7	Potassium	798.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.48	BJ	
		7440-23-5	Sodium	369.00	BJ	
		7440-28-0	Thallium	0.14	B	
		7440-62-2	Vanadium	24.10	J	
		7440-66-6	Zinc	380.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
D-1-1	MB5B70	7429-90-5	Aluminum	5420.00	J	
		7440-36-0	Antimony	1.41	BJ	
		7440-38-2	Arsenic	7.87	J	
		7440-39-3	Barium	159.00		
		7440-41-7	Beryllium	0.49	BJ	
		7440-43-9	Cadmium	1.66	J	
		7440-70-2	Calcium	35800.00		
		7440-47-3	Chromium	15.10		
		7440-48-4	Cobalt	5.77		
		7440-50-8	Copper	315.00	J	
		7439-89-6	Iron	11200.00		
		7439-92-1	Lead	1520.00	J	>SSL
		7439-95-4	Magnesium	4840.00		
		7439-96-5	Manganese	240.00	J	
		7439-97-6	Mercury	0.47		
		7440-02-0	Nickel	27.40	J	
		7440-09-7	Potassium	752.00		
		7782-49-2	Selenium	0.24	B	
		7440-22-4	Silver	0.51	BJ	
		7440-23-5	Sodium	212.00	BJ	
		7440-28-0	Thallium	0.13	BJ	
		7440-62-2	Vanadium	23.60	J	
		7440-66-6	Zinc	590.00	J	
D-1-2	MB5B71	7429-90-5	Aluminum	5890.00	J	
		7440-36-0	Antimony	1.01	J	
		7440-38-2	Arsenic	7.96	J	
		7440-39-3	Barium	179.00		
		7440-41-7	Beryllium	0.38	BJ	
		7440-43-9	Cadmium	0.54	J	
		7440-70-2	Calcium	32500.00		
		7440-47-3	Chromium	16.40		
		7440-48-4	Cobalt	6.50		
		7440-50-8	Copper	64.20	J	
		7439-89-6	Iron	13700.00		
		7439-92-1	Lead	2602.00	J	>SSL & BG
		7439-95-4	Magnesium	7560.00		
		7439-96-5	Manganese	480.00	J	
		7439-97-6	Mercury	1.17		
		7440-02-0	Nickel	35.70	J	
		7440-09-7	Potassium	882.70		
		7782-49-2	Selenium	0.23	B	
		7440-22-4	Silver	0.46	BJ	
		7440-23-5	Sodium	368.00	BJ	
		7440-28-0	Thallium	0.11	BJ	
		7440-62-2	Vanadium	42.20	J	
		7440-66-6	Zinc	307.00	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
D-1-3	MB5B72	7429-90-5	Aluminum	7170.00	J	
		7440-36-0	Antimony	0.01	UJ	
		7440-38-2	Arsenic	4.54	J	
		7440-39-3	Barium	26.60		
		7440-41-7	Beryllium	0.42	B J	
		7440-43-9	Cadmium	0.02	J	
		7440-70-2	Calcium	1071.00		
		7440-47-3	Chromium	36.90		
		7440-48-4	Cobalt	5.55		
		7440-50-8	Copper	9.33	J	
		7439-89-6	Iron	18700.00		
		7439-92-1	Lead	16.20	J	
		7439-95-4	Magnesium	1940.00		
		7439-96-5	Manganese	112.00	J	
		7439-97-6	Mercury	0.06		
		7440-02-0	Nickel	41.00	J	
		7440-09-7	Potassium	658.00		
		7782-49-2	Selenium	0.03	U	
		7440-22-4	Silver	0.02	B J	
		7440-23-5	Sodium	37.10	B J	
		7440-28-0	Thallium	0.08	B J	
		7440-62-2	Vanadium	22.80	J	
		7440-66-6	Zinc	29.90	J	
D-2-0	MB5B73	7429-90-5	Aluminum	5740.00		
		7440-36-0	Antimony	0.41	BJ	
		7440-38-2	Arsenic	3.66	J	
		7440-39-3	Barium	115.00	J	
		7440-41-7	Beryllium	0.38	B	
		7440-43-9	Cadmium	0.44	J	
		7440-70-2	Calcium	12300.00		
		7440-47-3	Chromium	19.60	J	
		7440-48-4	Cobalt	8.31	J	
		7440-50-8	Copper	43.28	J	
		7439-89-6	Iron	14500.00		
		7439-92-1	Lead	1210.00	J	>SSL
		7439-95-4	Magnesium	3870.00		
		7439-96-5	Manganese	255.00	J	
		7439-97-6	Mercury	0.28	J	
		7440-02-0	Nickel	56.60	J	
		7440-09-7	Potassium	894.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.27	BJ	
		7440-23-5	Sodium	351.00	BJ	
		7440-28-0	Thallium	0.12	B	
		7440-62-2	Vanadium	17.00	J	
		7440-66-6	Zinc	385.00		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
G-2-0	MB5B81	7429-90-5	Aluminum	6610.00		
		7440-36-0	Antimony	0.47	B	
		7440-38-2	Arsenic	4.81		
		7440-39-3	Barium	132.00	J	
		7440-41-7	Beryllium	0.42	B	
		7440-43-9	Cadmium	0.61	J	
		7440-70-2	Calcium	12200.00		
		7440-47-3	Chromium	46.20	J	
		7440-48-4	Cobalt	8.34	J	
		7440-50-8	Copper	46.70		
		7439-89-6	Iron	14800.00		
		7439-92-1	Lead	1450.00	J	>SSL
		7439-95-4	Magnesium	4304.00		
		7439-96-5	Manganese	309.00	J	
		7439-97-6	Mercury	0.31	J	
		7440-02-0	Nickel	86.60	J	
		7440-09-7	Potassium	951.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.28	BJ	
		7440-23-5	Sodium	446.00	BJ	
		7440-28-0	Thallium	0.14	B	
		7440-62-2	Vanadium	20.30		
		7440-66-6	Zinc	200.00		
D-2-1	MB5B74	7429-90-5	Aluminum	8804.00	J	
		7440-36-0	Antimony	0.04	BJ	
		7440-38-2	Arsenic	9.04	J	
		7440-39-3	Barium	112.00		
		7440-41-7	Beryllium	0.73	J	
		7440-43-9	Cadmium	0.08	J	
		7440-70-2	Calcium	13300.00		
		7440-47-3	Chromium	25.40		
		7440-48-4	Cobalt	6.92		
		7440-50-8	Copper	22.80	J	
		7439-89-6	Iron	17300.00		
		7439-92-1	Lead	425.00	J	>SSL
		7439-95-4	Magnesium	3150.00		
		7439-96-5	Manganese	422.00	J	
		7439-97-6	Mercury	0.82		
		7440-02-0	Nickel	27.20	J	
		7440-09-7	Potassium	764.00		
		7782-49-2	Selenium	0.17	B	
		7440-22-4	Silver	0.26	BJ	
		7440-23-5	Sodium	130.00	BJ	
		7440-28-0	Thallium	0.10	BJ	
		7440-62-2	Vanadium	22.00	J	
		7440-66-6	Zinc	64.50	J	

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
D-2-2	MB5B75	7429-90-5	Aluminum	1050.00		
		7440-36-0	Antimony	0.01	U J	
		7440-38-2	Arsenic	8.24		
		7440-39-3	Barium	139.00		
		7440-41-7	Beryllium	0.92		
		7440-43-9	Cadmium	0.08	J	
		7440-70-2	Calcium	16400.00		
		7440-47-3	Chromium	28.10	J	
		7440-48-4	Cobalt	11.60	J	
		7440-50-8	Copper	25.90		
		7439-89-6	Iron	20600.00	J	
		7439-92-1	Lead	531.00		>SSL
		7439-95-4	Magnesium	9280.00		
		7439-96-5	Manganese	558.00		
		7439-97-6	Mercury	1.04	J	
		7440-02-0	Nickel	88.00	J	
		7440-09-7	Potassium	869.00		
		7782-49-2	Selenium	0.05	BJ	
		7440-22-4	Silver	0.32	BJ	
		7440-23-5	Sodium	279.00	BJ	
		7440-28-0	Thallium	0.13	B	
		7440-62-2	Vanadium	25.80		
		7440-66-6	Zinc	70.10		
D-2-3	MB5B76	7429-90-5	Aluminum	6760.00		
		7440-36-0	Antimony	0.01	UJ	
		7440-38-2	Arsenic	6.45		
		7440-39-3	Barium	43.20		
		7440-41-7	Beryllium	0.51		
		7440-43-9	Cadmium	0.04	J	
		7440-70-2	Calcium	1340.00		
		7440-47-3	Chromium	15.40	J	
		7440-48-4	Cobalt	6.46	J	
		7440-50-8	Copper	9.56		
		7439-89-6	Iron	19400.00	J	
		7439-92-1	Lead	26.70		
		7439-95-4	Magnesium	2017.00		
		7439-96-5	Manganese	273.00		
		7439-97-6	Mercury	0.24	J	
		7440-02-0	Nickel	14.30	J	
		7440-09-7	Potassium	855.00		
		7782-49-2	Selenium	0.07	BJ	
		7440-22-4	Silver	0.02	BJ	
		7440-23-5	Sodium	63.70	BJ	
		7440-28-0	Thallium	0.10	BJ	
		7440-62-2	Vanadium	25.20		
		7440-66-6	Zinc	43.10		

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Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
E-1-0	MB5B77	7429-90-5	Aluminum	3930.00		
		7440-36-0	Antimony	0.17	B	
		7440-38-2	Arsenic	2.30		
		7440-39-3	Barium	49.70	J	
		7440-41-7	Beryllium	0.30	B	
		7440-43-9	Cadmium	0.24	J	
		7440-70-2	Calcium	3720.00		
		7440-47-3	Chromium	28.70	J	
		7440-48-4	Cobalt	6.05	J	
		7440-50-8	Copper	23.00		
		7439-89-6	Iron	9510.00		
		7439-92-1	Lead	415.00	J	>SSL
		7439-95-4	Magnesium	2840.00		
		7439-96-5	Manganese	203.00	J	
		7439-97-6	Mercury	0.21	J	
		7440-02-0	Nickel	102.00	J	
		7440-09-7	Potassium	614.00	J	
		7782-49-2	Selenium	0.15	UJ	
		7440-22-4	Silver	0.20	BJ	
		7440-23-5	Sodium	382.00	BJ	
		7440-28-0	Thallium	0.37	B	
		7440-62-2	Vanadium	12.90		
		7440-66-6	Zinc	74.40	J	
E-1-1	MB5B78	7429-90-5	Aluminum	6095.00		
		7440-36-0	Antimony	3.19	J	
		7440-38-2	Arsenic	7.62		
		7440-39-3	Barium	777.00		
		7440-41-7	Beryllium	0.50	B J	
		7440-43-9	Cadmium	4.52	J	
		7440-70-2	Calcium	30900.00		
		7440-47-3	Chromium	24.00	J	
		7440-48-4	Cobalt	7.48	J	
		7440-50-8	Copper	262.00		
		7439-89-6	Iron	25200.00	J	
		7439-92-1	Lead	8330.00		>SSL & BG
		7439-95-4	Magnesium	10400.00		
		7439-96-5	Manganese	387.00		
		7439-97-6	Mercury	0.59	J	
		7440-02-0	Nickel	49.90	J	
		7440-09-7	Potassium	795.00		
		7782-49-2	Selenium	0.48	BJ	
		7440-22-4	Silver	1.53	BJ	
		7440-23-5	Sodium	342.00	BJ	
		7440-28-0	Thallium	0.16	BJ	
		7440-62-2	Vanadium	23.40		
		7440-66-6	Zinc	2180.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
E-1-2	MB5B79	7429-90-5	Aluminum	4680.00		
		7440-36-0	Antimony	3.29	B J	
		7440-38-2	Arsenic	8.52		
		7440-39-3	Barium	606.00		
		7440-41-7	Beryllium	0.37	B	
		7440-43-9	Cadmium	2.44	J	
		7440-70-2	Calcium	22400.00		
		7440-47-3	Chromium	23.10	J	
		7440-48-4	Cobalt	6.25	J	
		7440-50-8	Copper	257.00		
		7439-89-6	Iron	22000.00	J	
		7439-92-1	Lead	5702.00		>SSL & BG
		7439-95-4	Magnesium	7360.00		
		7439-96-5	Manganese	326.00		
		7439-97-6	Mercury	0.58	J	
		7440-02-0	Nickel	51.40	J	
		7440-09-7	Potassium	642.00		
		7782-49-2	Selenium	0.46	BJ	
		7440-22-4	Silver	1.24	BJ	
		7440-23-5	Sodium	294.00	BJ	
		7440-28-0	Thallium	0.15	BJ	
		7440-62-2	Vanadium	21.50		
		7440-66-6	Zinc	1260.00		
E-1-3	MB5B80	7429-90-5	Aluminum	5660.00		
		7440-36-0	Antimony	4.39	BJ	
		7440-38-2	Arsenic	8.73		
		7440-39-3	Barium	1460.00		
		7440-41-7	Beryllium	0.44	B	
		7440-43-9	Cadmium	14.90	J	
		7440-70-2	Calcium	31500.00		
		7440-47-3	Chromium	67.00	J	
		7440-48-4	Cobalt	10.40	J	
		7440-50-8	Copper	1380.00		
		7439-89-6	Iron	56300.00	J	
		7439-92-1	Lead	14500.00		>SSL & BG
		7439-95-4	Magnesium	7290.00		
		7439-96-5	Manganese	602.00		
		7439-97-6	Mercury	0.66	J	
		7440-02-0	Nickel	142.00	J	
		7440-09-7	Potassium	762.00		
		7782-49-2	Selenium	0.75	BJ	
		7440-22-4	Silver	7.24	BJ	
		7440-23-5	Sodium	553.00	J	
		7440-28-0	Thallium	0.21	BJ	
		7440-62-2	Vanadium	21.60		
		7440-66-6	Zinc	7660.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
E-2-0	MB5B85	7429-90-5	Aluminum	6940.00		
		7440-36-0	Antimony	3.12	B	
		7440-38-2	Arsenic	7.29		
		7440-39-3	Barium	133.00	J	
		7440-41-7	Beryllium	0.47	B	
		7440-43-9	Cadmium	0.91	J	
		7440-70-2	Calcium	31200.00		
		7440-47-3	Chromium	20.30	J	
		7440-48-4	Cobalt	8.43	J	
		7440-50-8	Copper	76.30		
		7439-89-6	Iron	17100.00		
		7439-92-1	Lead	2710.00	J	>SSL & BG
		7439-95-4	Magnesium	8900.00		
		7439-96-5	Manganese	380.00	J	
		7439-97-6	Mercury	0.31	J	
		7440-02-0	Nickel	52.20	J	
		7440-09-7	Potassium	1140.00	J	
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.47	BJ	
		7440-23-5	Sodium	360.00	BJ	
		7440-28-0	Thallium	0.15	B	
		7440-62-2	Vanadium	23.50		
		7440-66-6	Zinc	293.00	J	
E-2-1	MB5B86	7429-90-5	Aluminum	8780.00		
		7440-36-0	Antimony	0.55	B J	
		7440-38-2	Arsenic	7.50		
		7440-39-3	Barium	207.00		
		7440-41-7	Beryllium	0.71		
		7440-43-9	Cadmium	0.85	J	
		7440-70-2	Calcium	11100.00		
		7440-47-3	Chromium	32.00	J	
		7440-48-4	Cobalt	7.37	J	
		7440-50-8	Copper	81.10		
		7439-89-6	Iron	26400.00	J	
		7439-92-1	Lead	1920.00		>SSL & BG
		7439-95-4	Magnesium	3230.00		
		7439-96-5	Manganese	264.00		
		7439-97-6	Mercury	0.70	J	
		7440-02-0	Nickel	34.40	J	
		7440-09-7	Potassium	1180.00		
		7782-49-2	Selenium	0.45	BJ	
		7440-22-4	Silver	0.64	BJ	
		7440-23-5	Sodium	239.00	BJ	
		7440-28-0	Thallium	0.24	BJ	
		7440-62-2	Vanadium	31.70		
		7440-66-6	Zinc	299.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

Continuation of TABLE 3
TAL Metals Analytical Results

Sample Location	CLP#	PARAMETERS				
		CAS Number	Analyte	Result (mg/kg)	Q	Remarks
E-2-2	MB5B87	7429-90-5	Aluminum	11700.00		
		7440-36-0	Antimony	0.64	BJ	
		7440-38-2	Arsenic	10.30		
		7440-39-3	Barium	215.00		
		7440-41-7	Beryllium	0.76		
		7440-43-9	Cadmium	0.88	J	
		7440-70-2	Calcium	20600.00		
		7440-47-3	Chromium	35.20	J	
		7440-48-4	Cobalt	11.60	J	
		7440-50-8	Copper	63.70		
		7439-89-6	Iron	27600.00	J	
		7439-92-1	Lead	1730.00		>SSL & BG
		7439-95-4	Magnesium	5620.00		
		7439-96-5	Manganese	1401.00		
		7439-97-6	Mercury	0.87	J	
		7440-02-0	Nickel	42.80	J	
		7440-09-7	Potassium	1550.00		
		7782-49-2	Selenium	0.17	BJ	
		7440-22-4	Silver	0.73	BJ	
		7440-23-5	Sodium	249.00	BJ	
		7440-28-0	Thallium	0.17	BJ	
		7440-62-2	Vanadium	36.70		
		7440-66-6	Zinc	338.00		
E-2-3	MB5B88	7429-90-5	Aluminum	7510.0		
		7440-36-0	Antimony	0.01	UJ	
		7440-38-2	Arsenic	7.47		
		7440-39-3	Barium	40.50		
		7440-41-7	Beryllium	0.48		
		7440-43-9	Cadmium	0.02	BJ	
		7440-70-2	Calcium	1650.00		
		7440-47-3	Chromium	28.50	J	
		7440-48-4	Cobalt	6.31	J	
		7440-50-8	Copper	10.90		
		7439-89-6	Iron	29600.00	J	
		7439-92-1	Lead	29.20		
		7439-95-4	Magnesium	1430.00		
		7439-96-5	Manganese	209.00		
		7439-97-6	Mercury	0.10	J	
		7440-02-0	Nickel	16.96	J	
		7440-09-7	Potassium	1370.00		
		7782-49-2	Selenium	0.03	UJ	
		7440-22-4	Silver	0.02	BJ	
		7440-23-5	Sodium	106.00	BJ	
		7440-28-0	Thallium	0.13	BJ	
		7440-62-2	Vanadium	26.50		
		7440-66-6	Zinc	142.00		

Note: Q= Concentration Qualifier; Qualifier are (B= Detected value less than the Contract Required Detection Limit; J= Estimated concentration due to data validation criteria; R= Rejected Value, U= Undetected value reported at the Instrument Detection Limit), >SSL = Above Soil Screening Levels, and BG= Above Three Times the Background.

ANNEX A
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN (QAPP)

FOR THE

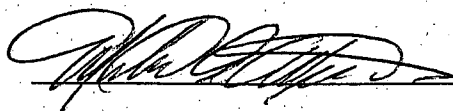
SHALLOW SOIL SAMPLING

AT THE

JEWETT WHITE LEAD COMPANY

STATEN ISLAND, NEW YORK

Project Officer's Signature:



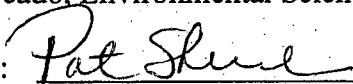
Date:

12/15/08

Project Officer's Name:

Michael A. Mercado, Environmental Scientist

Project Quality Assurance Officer's Signature:



Date:

12/15/08

Project Quality Assurance Officer's Name: Pat Sheridan, QA Officer

Date Prepared:

July 21, 2008

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Appendix B - U.S. EPA (Environmental Protection Agency). January 1991. Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2006: *Sampling Equipment Decontamination*. Office of Emergency and Remedial Response (OERR), Washington, DC.

Appendix C - U.S. EPA (Environmental Protection Agency). December 1995. Superfund Program Representative Sampling Guidance. OSWER Directive 9360.4-10. Interim Final. EPA/540/R-95-141. Office of Emergency and Remedial Response (OERR). Washington, D.C.

Appendix D - U.S. EPA (Environmental Protection Agency). January 1991. Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012: *Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*. OSWER Directive 9360.4-02. Interim Final. EPA/540/P-91/006. Office of Emergency and Remedial Response (OERR), Washington, DC.

Appendix E - U.S. EPA. January 2008. SOP # MAL-3: *Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma -Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ.

Appendix F - Field and Sample Documentation Examples

Appendix G - U.S. EPA. Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2). Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC (Appendix G)

1.0 Project Description

1.1 Problem Definition/Background

Jewett White Lead Co. site is located at the corner of Richmond Terrace and Park Ave. The address is 2000 Richmond Terrace, Port Richmond, Block 1006, lot 32, New York. The site is in a manufacturing zone with business adjoining the site and residential housing within 90 feet of the site.

From 1839 to 1898, the property was owned by Jewett & Son's White Lead Company, where white lead was produced. In 1898, the property was sold to National Lead Industries, producers of Dutch Boy Paints. Between 1949 and 1990 the property switched hands through a myriad of private owners and was recently purchased as a speculative venture.

In June 2008, the Council of the City of New York requested that EPA review the site as a potential Brownfields location. In July 2008, The Division of Environmental Science and Assessment (DESA), Hazardous Waste Support Branch (HWSB), Superfund Support Team (SST) has been requested by the EPA Emergency Remedial and Response Division (ERRD) to conduct a sampling event to assist in characterization of the shallow soils within the site property boundaries.

On October 3, 2008, Creative Habitat Corp conducted a Site Investigation and provided a summary report of the preliminary investigation into the alleged presence of lead in the soil at Jewett White Lead Company Site. Four test pits approximately 5 feet deep were dug. Samples were taken from three strata, 0 to 15 inches, 15 to 30 inches, and 30 to 48 inches. A composite sample was composed from sample from each of the four test pits for each of the three strata. Grab samples were taken from hole #2 and hole #3 at each of the three strata. The result of the analysis of these samples show elevated levels of lead at 0 to 15 inches and 15 to 30 inches. The photos also indicated that brick, gravel, concrete, and roots were present in the pits and that augers were not the ideal choice for collecting the samples.

On November 13, 2008, after review the summary report of October 3 above, ERRD requested a change to the sampling event from characterization to delineation.

1.2 Project/Task Description:

The purpose of this sampling event is to evaluate and delineate the potential of lead and PCB contamination on site. A Systematic Random Sampling Method will be used. The samples will be taken within a 50-foot square grid pattern, at four different depths. The depths will be 0 to 3 inches, at 12 inches at 24 inches and at 36 inches. It is anticipated that the maximum number of samples taken in this event would be sixty. Samples will be analyzed for Target Analyte List (TAL) metals and PCBs.

The purpose and scope of this QAPP is to specify the details related to the collection, analysis and validation of the soil samples to be collected by the USEPA Region 2, Division of Environmental Science and Assessment (DESA), Hazardous Waste Support Branch (HWSB), Superfund Support Team (SST) during December 15 – 23, 2008. See Table 1 for activity schedule.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Project/Task Organization

Table 3 identifies the key personnel and their corresponding responsibilities. Due to the work breakdown structure of the project, an organization list is provided instead of a concise organization chart.

2.2 Documentation and Records

The data collected for the sampling activities will be organized, analyzed, and summarized in a final project report that will be submitted the OSC according to the Project Schedule. The report will be prepared by the project officer and include appropriate data quality assessment. Standard methods and references will be used as guidelines for data reduction and reporting. All data generated will be reported in the standard CLP deliverable format.

3.0 QUALITY ASSURANCE (QA) OBJECTIVES FOR MEASUREMENT DATA (PARCC)

3.1 Quality Objectives and Criteria for Measurement Data

To assess data quality, PARCC (Precision, Accuracy, Representativeness, Completeness, and Comparability) parameters will be utilized. This is an integral part of the overall monitoring network design. Precision and accuracy are expressed in purely quantitative terms. The other parameters are only expressed using a mixture of quantitative and qualitative terms. All of these parameters are interrelated in terms of overall data quality and they may be difficult to evaluate separately due to these interrelationships. The relative significance of each of the parameters depends on the type and intended use of the data being collected. Therefore, these essential data quality elements are delineated as follows.

3.1.1 Analytical and sample collection precision

- For Organic Samples:

To assess error associated with analyte interference with the quantization of other analytes and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate samples (MS/MSDs) will be collected all VOA, BNA, PCB, pesticide and herbicide samples. Hence, one sample will have three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed. The equation for this calculation is presented below.

$$RPD = \frac{|MSR - MSDR|}{(MSR + MSDR)/2} \times 100$$

where: MSR = Matrix Spike Recovery
MSDR = Matrix Spike Duplicate Recovery

| | indicates absolute value of the difference. Hence, RPD is always expressed as a positive value.

- For Inorganic Samples:

To assess error associated with analyte interference with the quantization of other analytes and error due to laboratory bias and precision, Matrix Spike and Duplicate samples (MS/Ds) will be collected. Hence, one sample will have three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed. The equation for this calculation is presented below.

$$RPD = \frac{|S - D|}{(S+D)/2} \times 100 \quad \text{Where: } S = \text{Sample Result (original)} \\ D = \text{Duplicate Result}$$

| | indicates absolute value of the difference. Hence, RPD is always expressed as a positive value.

Sample collection precision and data representativeness will be assessed by collecting field replicate samples. The field replicates will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from these samples will provide data on the overall measurement precision.

3.1.2 Analytical and sample collection accuracy

Analytical accuracy will be assessed through the analysis of quality control samples specified in the analytical method (i.e., matrix spike, surrogate spike). The quality control samples will be used to reduce the sources of error associated with sample matrix, sample preparation and analysis techniques. Accuracy is defined as a measure of how close an analytically determined concentration is to the true value.

The analytical accuracy will be expressed as the percent recovery (%R) of an analyte which has been added to the environmental sample at a known concentration before analysis and is calculated according to the following equation.

$$\%R = [(A-B)/C] \times 100$$

where: A = The analyte concentration determined experimentally from the spiked sample.

B = The unspiked sample concentration.

C = The amount of spike added.

To assess sample accuracy, field quality control (QC) samples are usually collected including a rinsate, and/or field blanks. The blanks would be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel; improper decontamination procedures; improper shipment and storage; and/or on-site atmospheric contaminants.

3.1.3 Data representativeness

As previously discussed, data representativeness will be assessed by collecting field replicate samples and utilizing the proper sampling techniques and procedures. The field replicates are by definition equally representative of a given point and space and time. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. Therefore, data representativeness will be satisfied by ensuring that:

- The sampling program is followed according to:

- U.S. EPA (Environmental Protection Agency). October 1989. *Region II CERCLA Quality Assurance Manual*. Final Copy, Revision 1. Division of Environmental Services and Assessment, Edison, NJ; and
- U.S. EPA (Environmental Protection Agency). December 1995. *Superfund Program Representative Sampling Guidance*. OSWER Directive 9360.4-10. Interim Final. EPA/540/R-95/141. Office of Emergency and Remedial Response (OERR) Washington, D.C. (Appendix C)
- Proper sampling techniques are used in accordance with:
 - U.S. EPA (Environmental Protection Agency). January 1991. *Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012: Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*. Interim Final. EPA/540/P-91/006. Office of Emergency and Remedial Response (OERR), Washington, DC. The SOP is enclosed as Appendix D.
- Proper analytical procedures are followed and holding times of the samples are not exceeded in the laboratory according to:
 - U.S. EPA. January 2008. SOP # MAL-3: *Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E).
 - U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2). Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC (Appendix G).

3.1.4 Data completeness

Data completeness will be expressed as the percentage of valid data obtained from measurement system. For data to be considered valid, it must meet all the acceptable criteria including accuracy and precision, as well as any other criteria specified by the analytical method used.

- PCBs data generated by the CLP Laboratory will be validated by USEPA Region II, DESA/HWSB/HWSS according to the appropriate and current U.S. EPA Region II Data validation SOPs.
- TAL metals data generated by the Mobile Laboratory will be validated according to the U.S. EPA. January 2008. SOP # MAL-3: *Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E).

With 100% validation, the rationale for considering data points non-critical is not required.

3.1.5 Data comparability

To ensure data comparability, sampling and analysis for all samples will be performed using standardized analytical methods and adherence to the quality control procedures outlined in the methods and this QAPP. Therefore, the data will be comparable.

4.0 SAMPLING PROCEDURES

4.1 Sampling Process Design

As part of the remedial design process, U.S. EPA Region II DESA/HWSB/SST personnel will collect soil samples at the Site. Samples will be collected directly from open test pits using stainless steel scoops and place in stainless steel bowls. Soil sampling will follow methods as described in *U.S. EPA/ERT SOP #2012: Soil Sampling* which can be found as Appendix D. Sample locations will be chosen according to a Systematic Random Sampling Method. The samples will be taken within a 50-foot square grid pattern, at four different depths. The depths will be 0 to 3 inches, 12 inches, 24 inches and 36 inches. It is anticipated that the maximum number of samples taken in this event would be sixty-eight.

A total of sixty-eight (68) soil samples will be collected including QA/QC samples. For quality assurance, quality control purposes, four (4) blind duplicate, four (4) matrix spike and duplicates, and four (4) background sample will be collected.

Samples will be delivered hand delivered to the U.S. EPA Mobile Laboratory in Edison NJ and shipped via FEDEX to the CLP Laboratory within 24 hours of sampling. Each sample will be analysis for TAL metals at the Mobile Laboratory according to U.S. EPA. January 2008. SOP # *MAL-3: Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E) and samples for PCBs will analysis according to U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2) Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC (Appendix G).

Each sample will be collected by a member of the US EPA Region II, DESA/HWSB. The sample collection will be in accordance with U.S. EPA (Environmental Protection Agency) .January 1991. Environmental Response Team (ERT) Standard Operating Procedure (SOP) #2012: *Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*. OSWER Directive 9360.4-02. Interim Final. EPA/540/P-91/006. Office of Emergency and Remedial Response (OERR), Washington, DC (Appendix D).

To assess error associated with analyte interference with the quantitation of other analytes and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate for organic samples (MS/MSDs) and Matrix Spike and Duplicate for inorganic samples will be collected. Sample collection frequency for this site will be one MS/MSD or MS/D per twenty (20) soil samples collected per analytical parameter/fraction analyzed. Double sample collection volume is required for both MS/MSD and MS/D analysis.

To assess sample collection precision and data representativeness, a field replicate sample will be collected. The field replicate will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. Sample collection frequency will be one field replicate per twenty (20) soil samples collected per analytical parameter/ fraction analyzed.

To assess sample accuracy, field quality control samples will be collected including a rinsate blank. The blanks will be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel; improper decontamination procedures; improper shipment and storage; and/or on-site atmospheric contaminants. Rinsate

blanks will be prepared in the field by pouring deionized water over decontaminated sampling equipment which in this case would entail pouring the water over stainless steel scoops and bowls. Sample frequency will be one rinsate blank for each type of equipment used per each day a decontamination event is carried out. Rinsate blanks will be analyzed for TAL metal and PCBs

4.2 Sampling Methods Requirements

4.2.1 Standard operating procedures

As previously stated, all soil sampling will be in accordance with the *U.S. EPA Region II CERCLA Quality Assurance Manual*; and *U.S. EPA Superfund Program Representative Sampling Guidance* OSWER Directive 9360.4-10, Interim Final, EPA/540/R-95/141, Office of Emergency and Remedial Response (OERR), Washington, D.C. Furthermore, the specific Standard Operating Procedure (SOP) utilized for soil sampling is the *U.S. EPA ERT SOP #2012: Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*.

4.2.2 Sample collection methodology

All samples including QA/QC samples will be collected by personnel from the USEPA Region II DESA/HWSB. Sample locations will be demarcated on-site utilizing flags. Test pits will be dug to a maximum depth of four feet. The total number of soil samples includes: sixty-eight (68) environmental samples to include, four (4) field replicates (i.e., laboratory quality control sample), four (4) MS/Ds, four (4) Background samples. The number of rinsate blanks will be at a rate of one per each day equipment is decon. As previously stated, the specific SOPs utilized will be the *U.S. EPA ERT SOP #2012: Soil Sampling*, from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*. Samples will be collected at depth of zero (0) to three (3) feet utilizing stainless steel scoops and bowls.

For MS/D sample collection, double volume is required. MS/MSD samples require three times the volume. Sample preservation for all environmental samples required only wet ice with samples cooled to 4°C. All sample bottles comply with the *U.S. EPA Specifications and Guidance for Contaminant-Free Sample Containers*. Samples will be maintained in sealed cooler(s) with ice at 4°C. TAL metals samples will be hand delivered to the laboratory in Edison, NJ and PCBs samples shipped via FEDEX to the CLP Laboratory within 24 hours of sampling.

4.2.3 Sample Containers, Volume, Preservation, and Holding Times

Sample container type, volume, preservation, and holding times are dependent upon analytical parameter and fraction and are matrix specific. Table 4 outlines the sample container type, volume, preservation, and holding times for samples to be collected on-site.

4.2.4 Field measurement data collection

Air monitoring will be conducted at this site by contract site support personnel. Field data sheets and the field notebook will be completed for each sample collected. The *Soil Field Data Sheet* will record sample location; upper limit of observed contamination; sample depth; time of sample collection; lowest depth of observed contamination; laboratory sample number; laboratory sample analysis; private laboratory sample number; and sample collection notes and/or observations. The field notebook will be completed as provided for in Section 8.4: Data

Quality Management of the QAPP.

4.2.5 Sampling Equipment Decontamination

Soil samples will be collected using stainless steel scoops and bowls. The tools to be used on-site will also be decontaminated prior to site activities. Decontamination of equipment will be done at the Edison facility and on-site whenever necessary. A rinsate blank sample will be collected each day for each decontamination event conducted in the field. The sampling equipment will also be decontaminated after the sampling event is complete at the US EPA Edison facility. All decontamination procedures will be in accordance with the following:

- *U.S. EPA ERT SOP #2006: Sampling Equipment Decontamination from the Compendium of ERT Soil Sampling and Surface Geophysics Procedures (Appendix B).*
- *U.S. EPA Region II CERCLA Quality Assurance Manual*

4.2.6 Management of Investigative-Derived Wastes (IDW)

The wastes that are anticipated on being generated during this sampling event are soils and personnel protective equipment (i.e. tyveks, booties, etc.). The excess soils will be placed back into the hole from which it was generated.

The personnel protective equipment will be cleaned of gross contamination, bagged and disposed of appropriately. All of the anticipated waste will be left on-site.

5.0 SAMPLE CUSTODY

5.1 Special Training Requirements/Certification

To perform the operations of this sampling event, SST will be dealing with the sampling activities on-site. This can imminently expose SST personnel to potential occupational environmental hazards. As a result, it is important for SST field personnel to be familiar with:

- Identifying methods and procedures for recognizing, evaluating and controlling hazardous substances.
- Identifying concepts, principles, and guidelines to properly protect SST field personnel.
- Discussing regulations and action levels to ensure the health and safety of SST field oversight personnel.
- Discussing the fundamentals needed to develop organizational structures and standard operating procedures to mitigate potential environmental hazards.
- Demonstrating the selection and use of dermal and respiratory protective equipment.
- Demonstrating the selection and use of direct-reading air monitoring instrumentation

In practice, not all of the potential environmental hazards which may be inherent to a site can be

readily anticipated. To mitigate these circumstances, SST field personnel must learn, follow, and enforce the published rules governing occupational health and safety. In addition, they must maintain awareness and exercise common sense and good judgment when confronting possible unsafe situations. Consequently, all divisions and offices at the Edison facility are required to provide their staff with the necessary safety training and equipment to perform their assigned duties.

For SST personnel, all training and certification requirements are to be undertaken in accordance with the protocols set forth in the 1995 "Edison Health and Safety Manual." Specifically, this requires completion of the forty (40) hour "Hazardous Materials Incident Response Operations" training pursuant to Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1910.120 and U.S. EPA Order 1440.2. This is to be supplemented by completing the twenty four (24) hour OSHA sanctioned supervised on-site operations certification training. In conjunction, SST personnel are also to maintain certifications for:

- The supplemental eight (8) hour annual health and safety refresher training.
- Fit testing for atmosphere supplying respirators (Level B) and air purifying respirators (Level C).
- Enrollment in a physician authorized medical monitoring program.

5.2 Sample Handling and Custody Requirements

5.2.1 Sample handling and shipment

Field data sheets and the field notebook will be completed for each sample collected. All field and sample documents will be legibly written in indelible ink. Any corrections or revisions will be made by lining through the original entry and initialing the change. The *Field Data Sheet* will record sample location; sample depth; sample type; equipment used; analysis; sample characteristics; sampling personnel and weather. For reference, the field data sheets are presented in Appendix F. The field notebook will be used by field personnel to record all aspects of sample collection and handling, visual observations, and field measurements. The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. The sample team or individuals performing a particular sampling activity are required to maintain a field notebook. This field notebook will be a bound weatherproof logbook that shall be filled out at the location of sample collection immediately after sampling. All entries will be signed by the individuals making them. At a minimum, the logbook will contain sample particulars including sample number, collection time, location, descriptions, methods used, daily weather conditions, field measurements, name of sampler(s), sample preservation, names of on-site personnel, and other site-specific observations including any deviations from protocol. Sample labels will be securely affixed to the sample container and include only the sample identification number as per protocol. The sample labels will be sealed with clear tape to maintain sample label integrity. Once sealed, samples will be placed in a polyethylene bag inside a waterproof High Density Polyethylene (HDPE) cooler. The coolers will be packed with sufficient wet ice to cool the samples to 4°C. A temperature blank will be in each cooler.

All samples will be the responsibility of the Project Officer to see that the samples are hand delivered by a U.S. EPA employee to the MAL and shipped via FEDEX to the CLP LAB. All samples will be shipped within 24 hours of sampling.

5.2.2 Sample custody procedures

Standard U.S.EPA Chain-of-Custody Procedures will be followed for all samples and be in accordance with the U.S.EPA Region II *CERCLA Quality Assurance Manual*. The Forms II Lite software will be used to generate the Chain of Custodies for both the MAL and CLP. The Traffic Report & Chain of Custody Records will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept for each individual who has signed it. The chain-of-custody records will include, at a minimum, sample identification number, number of samples collected, sample collection date and time, sample type, sample matrix, sample container type, sample analysis requested, sample preservation, and the name(s) and signature(s) of samplers and all individuals who have had custody. Sample labels will only include the sample identification number to prevent any conflict of interest issues for samples. Custody seals will demonstrate that a sample container or cooler has not been opened or tampered with. The sampler will sign and date the custody seal and affix it to the container and/or cooler in such a manner that it cannot be opened without breaking the seal.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 Instrument Calibration and Frequency

For the calibration and preventative maintenance:

The EPA Mobile Laboratory in Edison, NJ will follow:

- U.S. EPA Mobile Laboratory, Edison, NJ, SOPs # C-91: *Analysis of Pesticides and PCBs in Aqueous, Soil/Sediment, and Waste Oil/Transformer Fluid Matrices*, Revision Number 2.0 dated: March 2007 (Appendix E)

The CLP Laboratory will follow:

- U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2). Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC (Appendix G).

7.0 ANALYTICAL PROCEDURES

7.1 Analytical Methods Requirements

The Mobile Laboratory will be using SOP # *MAL-3* (Appendix E)

The CLP Laboratory will be using U.S. EPA CLP SOW # SOM01.2 (Appendix G)

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 Data Review, Validation and Verification Requirements:

The Mobile Laboratory validates their data according to the: U.S. EPA. January 2008. SOP # *MAL-3: Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ.

The CLP Laboratory validates their data according to the: Standard methods and references will be used as guidelines for data reduction and reporting. All CLP SOW data generated by the CLP laboratory will be reported in standard CLP deliverable format. Also, all Non-RAS data generated by a private laboratory will be reported in standard CLP deliverable format. For a CLP laboratory, all data validation reports will be summarized according to:

- HWSS SOPs: HW-33: U.S.EPA (Environmental Protection Agency). March 2003. *Contract Laboratory Program (CLP) Statement of Work (SOW) for the Analysis of Low/Medium Concentrations of Volatile Organic Compounds (SOM01.2)*

8.2 Validation and Verification Methods

U.S. EPA. January 2008. SOP # MAL-3: *Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E).

For CLP Lab: All CLP data will be validated by the following HWSS Data Validation SOPs: HW-33: U.S.EPA *CLP SOW for the Analysis of Low/Medium Concentrations of Volatile Organic Compounds [SOM01.2]*.

8.3 Data Acquisition Requirements

Data acquisition from non-direct measurements such as data from databases or literature is not anticipated at this time. Therefore, this is not applicable.

8.4 Data Quality Management

All project data and information must be documented in a format that is usable by project personnel. This section of the QAPP describes how project data and information will be documented, tracked, and managed from their generation in the field to final use and storage in a manner that ensures data integrity and defensibility. All field and sample documents will be legibly written in indelible ink. Any correction or revisions will be made by lining through the original entry and initialing the change.

The following field and sample documentation will be maintained. Examples are presented in Appendix F

- The field logbook is a descriptive notebook detailing site activities and observations so that an accurate, factual account of field procedures may be reconstructed. The sample team or individuals performing a particular sampling activity are required to maintain a field notebook. This field notebook will be a bound weatherproof logbook that shall be filled out at the location of sample collection immediately after sampling. All entries will be signed by the individuals making them. At a minimum, the logbook will contain sample particulars including sample number, collection time, location, descriptions, methods used, daily weather conditions, field measurements, name of sampler(s), sample preservation, and other site-specific observations including any deviations from protocol.
- Field data sheets and corresponding sample labels are used to identify samples and document field sampling conditions and activities. The field data sheets will be completed at the time of

sample collection and will include the following: sample location; upper limit of observed contamination; sample depth; time of sample collection; lowest depth of observed contamination; laboratory sample number; laboratory sample analysis; private laboratory sample number; private laboratory sample analysis; and sample collection notes and/or observations.

- Sample labels will be securely affixed to the sample container and include only the sample identification number as per protocol to prevent any conflict of interest issues. The sample labels will be sealed with clear tape to maintain sample label integrity.
- The Traffic Report & Chain of Custody Records will be maintained from the time of sample collection until final deposition. Every transfer of custody will be noted and signed for and a copy of the record will be kept for each individual who has signed it. The chain-of-custody records will include, at a minimum, sample identification number, number of samples collected, sample collection date and time, sample type, sample matrix, sample container type, sample analysis requested, sample preservation, and the name(s) and signature(s) of samplers and all individuals who have had custody.
- Custody seals will demonstrate that a sample container or cooler has not been opened or tampered with. The sampler will sign and date the custody seal and affix it to the container or cooler in such a manner that it cannot be opened without breaking the seal.
- Procedures are provided for project personnel to make changes, take corrective actions and document the process through Corrective Action Request Forms. Corrective action can occur during field activities, laboratory analysis, data validation, and data assessment. For further information, refer to Section 13.0: Corrective Action.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 Quality Control Requirements

As previously stated, to assess data quality, PARCC (Precision, Accuracy, Representativeness, Completeness, and Comparability) parameters will be utilized. These essential data quality elements are delineated as follows.

9.1.1 Data precision

Precision is defined as a measure of the reproducibility of individual measurements of the same property under a given set of conditions. The overall precision of measurement data is a mixture of sampling and analytical factors.

9.1.1.1 Analytical precision

- For Organic Samples:

To assess error associated with analyte interference with the quantitation of other analyses and error due to laboratory bias and precision, Matrix Spike and Matrix Spike Duplicate samples (MS/MSDs) will be collected. One sample will have three aliquots. The first aliquot will be analyzed routinely for the parameters of interest, while the other two aliquots will be spiked with known quantities of the parameters of interest prior to analysis. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the

analyses performed.

$$RPD = \frac{|MSR - MSDR|}{(MSR + MSDR)/2} \times 100$$

Where: MSR = Matrix Spike Recovery
MSDR = Matrix Spike Duplicate Recovery
| | indicates absolute value of the difference.

The analytical precision for the analytical methods chosen in terms of estimated RPD.

- For Inorganic Samples:

To assess error associated with analyte interference with the quantitation of other analyses and error due to laboratory bias and precision, Matrix Spike and Duplicate samples (MS/Ds) will be collected. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed.

$$RPD = \frac{|S - D|}{(S + D)/2} \times 100$$

Where: S = Sample Result (original)
D = Duplicate Result
| | indicates absolute value of the difference.

The analytical precision for the analytical methods chosen in terms of estimated RPD.

9.1.1.2 Sample collection precision

Sample collection precision will be assessed by collecting field replicate samples. The field replicates will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from these samples will provide data on the overall measurement precision.

9.1.2 Data accuracy

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement is. It is difficult to measure accuracy for the entire data collection activity. Sources of error are the sampling process, field contamination, preservation, handling, sample matrix, sample preparation and analysis techniques.

9.1.2.1 Analytical accuracy

Analytical accuracy will be assessed through the analysis of quality control samples specified in the analytical method (i.e., matrix spike). The analytical accuracy will be expressed as the percent recovery (%R) of an analyte which has been added to the environmental sample at a known concentration before analysis and is calculated according to the following equation. See table 5 for estimated accuracy.

$$\%R = \frac{[SSR - SR]}{SA} \times 100$$

Where: SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Both the analytical precision and accuracy for the analytical methods chosen in terms of estimated percent recovery.

9.1.2.2 Sample collection accuracy

To assess sample accuracy, field quality control samples will be collected and evaluated including rinsate blanks. The blanks will be used to evaluate errors arising from potential cross-contamination due to: improper handling of samples by collectors and lab personnel, improper decontamination procedures, improper shipment and storage, or on-site atmospheric contaminants.

9.1.3 Data Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or and environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program and proper laboratory protocol. The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected. Therefore, data representativeness will be assessed by collecting field replicate samples. The field replicates are by definition equally representative of a given point in space and time.

In addition, as previously stated, data representativeness will be satisfied by ensuring that the sampling program is followed according to the *U.S. EPA Region II CERCLA Quality Assurance Manual*; and the *U.S. EPA Superfund Program Representative Sampling Guidance* for soil, Volume 1. Also, proper sampling techniques will be used in accordance with the *U.S. EPA ERT SOP #2012: Soil Sampling*; from the *Compendium of ERT Soil Sampling and Surface Geophysics*.

Furthermore, proper analytical procedures will be followed and holding times of the samples will not be exceeded in the laboratory.

- The U.S. EPA Mobile Laboratory, Edison, uses SOP # *MAL-3: Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E).
- The U.S. EPA Contract Laboratory Program (CLP) uses U.S. EPA. Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2). Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC. (Appendix G).

9.1.4 Data Comparability

Comparability is defined as the confidence with which one data set can be compared to another. Field and laboratory procedures greatly affect comparability. Therefore, to optimize comparability, sampling and analysis for all samples will be performed using standardized analytical methods and adherence to the quality control procedures outlined in the methods and this QAPP. Therefore, the data will be compared.

9.1.5 Data Completeness

Completeness is defined as the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data completeness will be expressed as the percentage of valid data obtained from measurement system. For data to be considered valid, it must meet all the acceptable criteria including accuracy and precision, as well as any other criteria specified by the analytical method used. Therefore, all data points critical to the sampling program in terms of completeness will be 100% validated by USEPA Region II DESA/HWSB in accordance with the US EPA Region 2 SOPs. With 100% validation, the rationale for considering data points non-critical is not required.

10.0 Performance and Systems Audits

10.1 Assessments and Response Actions

No performance audit of field operations is anticipated at this time. If conducted, performance and systems audits will be in accordance with:

- U.S. EPA (Environmental Protection Agency) Region II. October 1994. *SOP No. HW-20: Standard Operation Procedure (SOP) for Conducting CERCLA Field Audits*. Revision 0. Division of Environmental Services and Assessment, Hazardous Waste Support Branch, Hazardous Waste Support Section, Edison, NJ.

11.0 PREVENTIVE MAINTENANCE

11.1 Instrument/Equipment Testing, Procedures & Scheduled Inspection and Maintenance Requirements

As previously stated, calibration and preventative maintenance of analytical laboratory equipment will follow procedures as specified in paragraph 8.0 Data Reduction, Validation and Reporting of the QAPP.

11.2 Inspection/Acceptance Requirements for Supplies and Consumables

All blanks (e.g., rinsate blank) will be prepared using demonstrated analyte free, deionizer water as specified in the U.S. EPA Region II *CERCLA Quality Assurance Manual*. The demonstrated analyte free water meets the assigned criteria values for the Contract Laboratory Program (CLP) Contract Required Detection Limits (CRQLs) and Contract Required Quantization Limits (CRQLs) as outlined in the most recent CLP Statements of Work (SOWs). The criterion is as follows: purgeable organics < 10 ppb; semi-volatile organics < CRQL; pesticides < CRQL; PCBs < CRQL; inorganic < CRDL. However, for common laboratory contaminants (i.e., methylene chloride, acetone, toluene, 2-butanone, and phthalates), the allowable limits are three times the respective CRQLs. All sample bottles comply with OSWER Directive #9240.0-05A; U.S. EPA *Specifications and Guidance for obtaining Contaminant-Free Containers*, EPA 540/R-93/051.

12.0 SPECIFIC ROUTINE PROCEDURES/MEASUREMENT PARAMETERS INVOLVED

12.1 Reconciliation with Data Used to Assess PARCC for Quality Objectives Measurement

Sample collection precision will be evaluated by collecting and analyzing both a field duplicate

sample and collocated samples (i.e., split samples). The field duplicate samples will be used to evaluate errors associated with sample heterogeneity, sampling methodology and analytical procedures. The analytical results from the field duplicate samples will provide data on the overall measurement precision. Precision will be reported as the relative percent difference (RPD) for two measurements. The acceptance criteria for the field duplicate samples are located in Table 5.

Data will be generated through the collection of soil samples at the Jewett White Lead Company Site. This data will be used to determine if there is soil contamination at the site, the extent of contamination, evaluate potential health threats, and determine the environmental impacts.

13.0 CORRECTIVE ACTION

13.1 Assessments and Response Actions

Procedures are provided for project personnel to make changes, take corrective actions and document the process through Corrective Action Request Forms. Corrective action can occur during field activities, laboratory analysis, data validation, and data assessment.

Corrective action in the field may be necessary when the monitoring network design is changed. A change in the field includes: increasing the number or type of samples or analyses; changing sampling locations; and/or modifying sampling protocol. When this occurs, the project officer or project QA officer will identify any suspected technical or QA deficiencies and note them in the field logbook. The project QA officer will be responsible for assessing the suspected deficiency and determining the impact on the quality of the data. Development of the appropriate corrective action will be the responsibility of the OSC.

Laboratory corrective action will be in accordance,

- For EPA Mobile Laboratory: SOP # *MAL-3: Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples by Inductively Coupled Plasma-Mass Spectrometry*, Revision# 3, DESA/HWSB. Edison, NJ (Appendix E).
- For The U.S. EPA Contract Laboratory Program (CLP): U.S. EPA. Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration (SOM01.2). Office of Emergency and Remedial Response (OERR), Analytical Operations Center (AOC), Washington, DC. (Appendix G)

14.0 QA REPORTS TO MANAGEMENT

14.1 Distribution List

Table 3 identifies project personnel who shall receive copies of the approved QAPP and any subsequent revisions.

14.2 Reports to Management

The data collected as a result of sampling activities; will be organized, analyzed and summarized in a final project report that will be submitted to the all project officers according to the Project Schedule. The report will be prepared by the project officer or project quality assurance officer

and include appropriate data quality assessment.

The sampling and analysis protocol is listed as Table 4.

TABLE 1 – ACTIVITY SCHEDULE	
ACTIVITY	DATE
Date of the request which initiates the project.	July 9, 2008
Review and Background information	July 9, 2008
Date by which the project plan will be submitted to all interested parties.	July 21, 2008
Obtain site access	Prearranged by ERRD
Date by which comments on the plan are to be received by the project officer.	July 31, 2008
Date(s) of the field reconnaissance.	July 10, 2008 & October 14, 2008
Date(s) of the field sampling activities.	December 15-23, 2008
Date(s) the samples will be submitted to the laboratory for analysis.	All samples will be hand-delivered to the Mobile Laboratory and shipped via FEDEX to CLP Laboratory within 24 hours of sampling.
Date(s) by which all analyses are to be completed and the data submitted to the project officer.	45 day turnaround
Date(s) the data will be entered into STORET or other computerized systems.	Not applicable.
Date of the completion of the draft interim/final project report. (Sampling Trip Report)	Within one week of the end of the sampling event
Date for the issuance of the final project report.	Within two weeks of receipt of validated analytical data.

TABLE 2 – QAPP DISTRIBUTION LIST	
Project Personnel	Title
Nick Magriples, On-Scene Coordinator (OSC) ERRD/RAB	Overall Project Coordinator
Idelfonso Acosta, Site Assessment Manager (SAM) ERRD/SPB	Pre-remedial Project Manager
Jan Hagiwara, Site Assessment Manager (SAM) ERRD/SPB	Pre-remedial Project Manager
Michael A. Mercado, DESA/HWSB Superfund Support Team (SST)	Project Officer
Pat Sheridan, DESA/HWSB Superfund Support Team (SST)	Quality Assurance Officer

TABLE 3 – PROJECT/TASK ORGANIZATION

PROJECT PERSONNEL	RESPONSIBILITY
Nick Magriples, On-Scene Coordinator (OSC) ERRD/RAB	Site Project Manager
Idelfonso Acosta, Site Assessment Manager (SAM) ERRD/SPB	Pre-remedial Project Manager
Jan Hagiwara, Site Assessment Manager (SAM) ERRD/SPB	Pre-remedial Project Manager
Michael A. Mercado, Project Officer DESA/Hazardous Waste Support Branch	Project Management/Safety Officer Sampling Operations
Mark Denno, Sampler DESA/Hazardous Waste Support Branch	Sampling Operations/ Field Support
Diane Salkie DESA/Hazardous Waste Support Branch	Field Support
Christina Leung DESA/Hazardous Waste Support Branch	Field Support
Pat Sheridan, Project Quality Assurance Officer DESA/ Hazardous Waste Support Branch	Report QA
Robert Finke, Environmental Scientist DESA/ Hazardous Waste Support Branch	Mobile Laboratory analysis of TAL metals analysis/ technician
CLP Lab	Laboratory analysis of PCB sample, laboratory QC, data processing activities
DESA/Hazardous Waste Support Branch	Overall QA

**TABLE 4 – Consolidated Iron Site
Remedial Investigation - Soil Sampling
Sampling and Analysis Protocols and Parameters**

Sample Type	Number of Samples	Matrix	Parameter/Fraction	Sample Container ¹	Sample Preservation	Analytical Method	Method Detection Limit	Holding Time ²
Environmental	68*	Soil	<u>TAL Metals</u>	(1) 4 oz. Wide-mouth glass jar	Cool to 4°C	MAL#6	Analyte Specific 0.02 – 22.48 mg/kg	6 months
	20*	Soil	<u>TCL PCBs</u>	(1) 4 oz. Wide-mouth glass jar	Cool to 4°C	SOM01.2	33 ug/kg	10 days to extract, 40 days analyze
Rinsate Blank	2	Aqueous	<u>TAL Metals</u>	(1) 1 Lt. Wide-mouth Plastic Bottle	Cool to 4°C w/pH 2 (HNO ₃)	MAL#6	Analyte Specific (0.07 – 161 ug/l)	6 months
			<u>TCL PCBs</u>	(2) 1lt. Wide-mouth amber glass jar	Cool to 4°C	SOM01.2	1 ug/L	5 days to extract, 40 days analyze

Legend:

¹ The number in parentheses in the "Sample Container" column denotes the number of containers needed.

All sample bottles comply with OSWER Directive #9240.0-05A, *Specifications and Guidance for obtaining Contaminant-Free Containers*, EPA 540/R-93/051.

² All holding times listed are Contractual Holding Times and are from the date of Verified Time of Sample Receipt (VTSR).

* The number of samples indicated includes four field replicate samples, four MS/Ds, and three background samples.

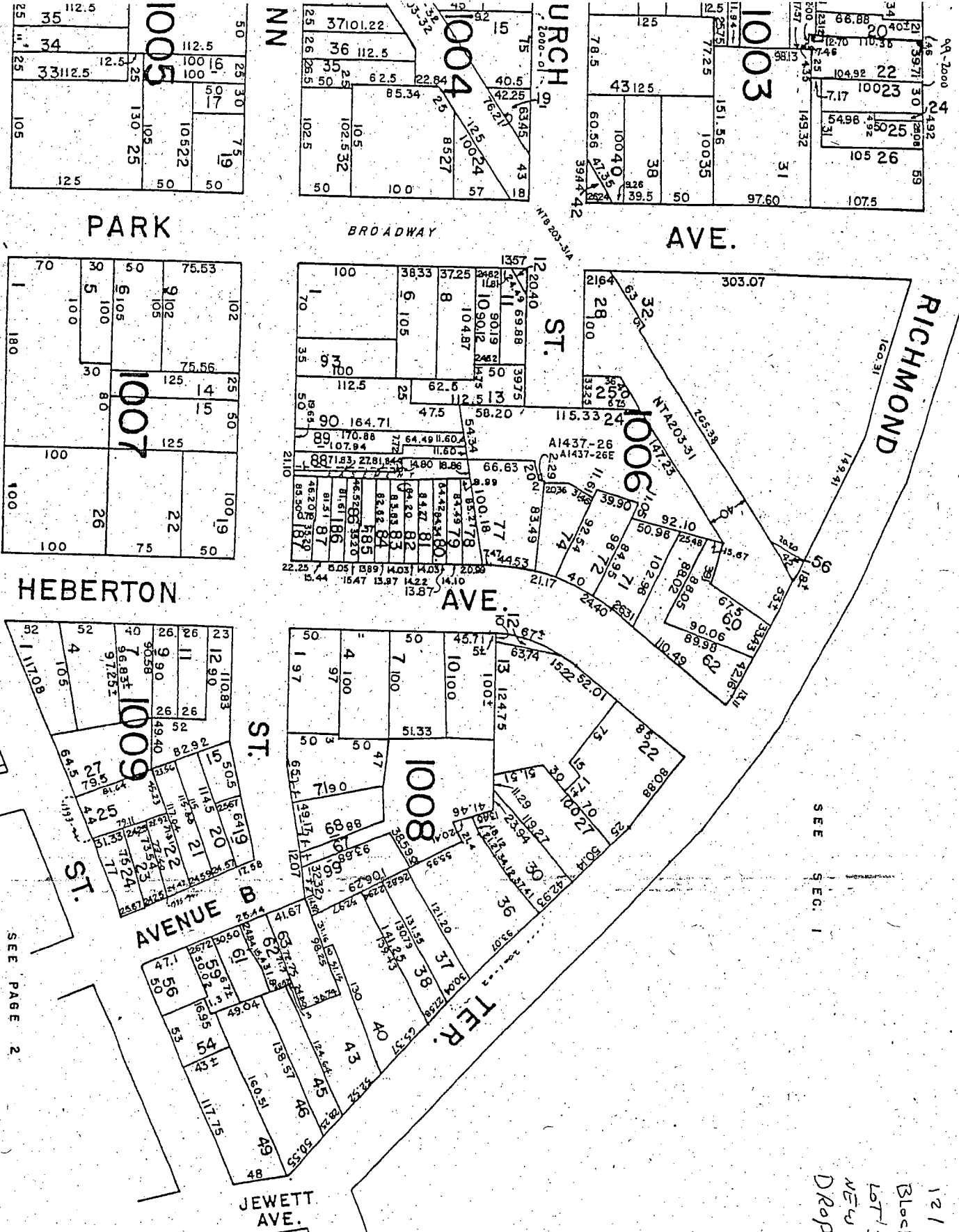
TABLE 5: PRECISION AND ACCURACY

Laboratory	Sample Parameter/Fraction	Sample Matrix	Analytical Method	Quantization Limit	Quantization Limit Units	Estimated Accuracy	Accuracy Protocol	Estimated Precision	Precision Protocol
MAL	TAL Metals	Soil	MAL-3	5 – 500 mg/Kg	ppm levels	75 – 125%	CLP-RAS	±20%RPD	MAL-3
CLP	PCBs	Soil	SOM01.2	33 ug/Kg	ppb levels	29%-135%	CLP-RAS	<20%RPD	CLP-RAS
MAL	TAL Metals	Aqueous	MAL-3	0.5 – 5000 ug/L	ppb levels	75 – 125%	CLP-RAS	±20%RPD	MAL-3
CLP	PCBs	Aqueous	SOM01.2	1 ug/L	ppb levels	29%-135%	CLP-RAS	<20%RPD	CLP-RAS

APPENDIX A
SITE MAPS

12/17/00
Block 1008
Lot 36 AFF.
NEW 37
Drop 32, 33 & 35

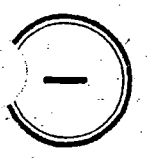
SEE SEC. 1



PAGE 3

SEE PAGE 3

SEE PAGE 2



Photos from EPA site visit, 2000 Richmond Terrace, Staten Island, 6/13/08

Fig. 1. View of 2000 Richmond Terrace from intersection of Park Avenue (on right) & Richmond Terrace



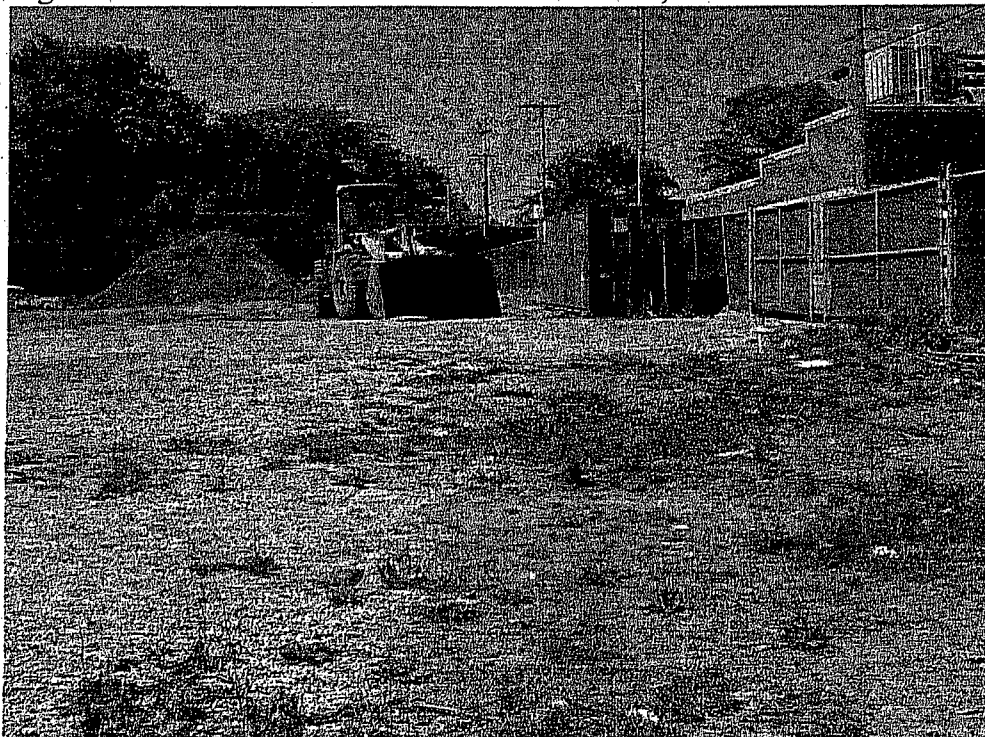
Fig. 2. 2000 Richmond Terrace - view inside fence, from Park Avenue looking NE



Fig. 3. 2000 Richmond Terrace - view inside fence, from Park Avenue looking SE



Fig. 4. 2000 Richmond Terrace -view inside fence, from Richmond Terrace looking SW

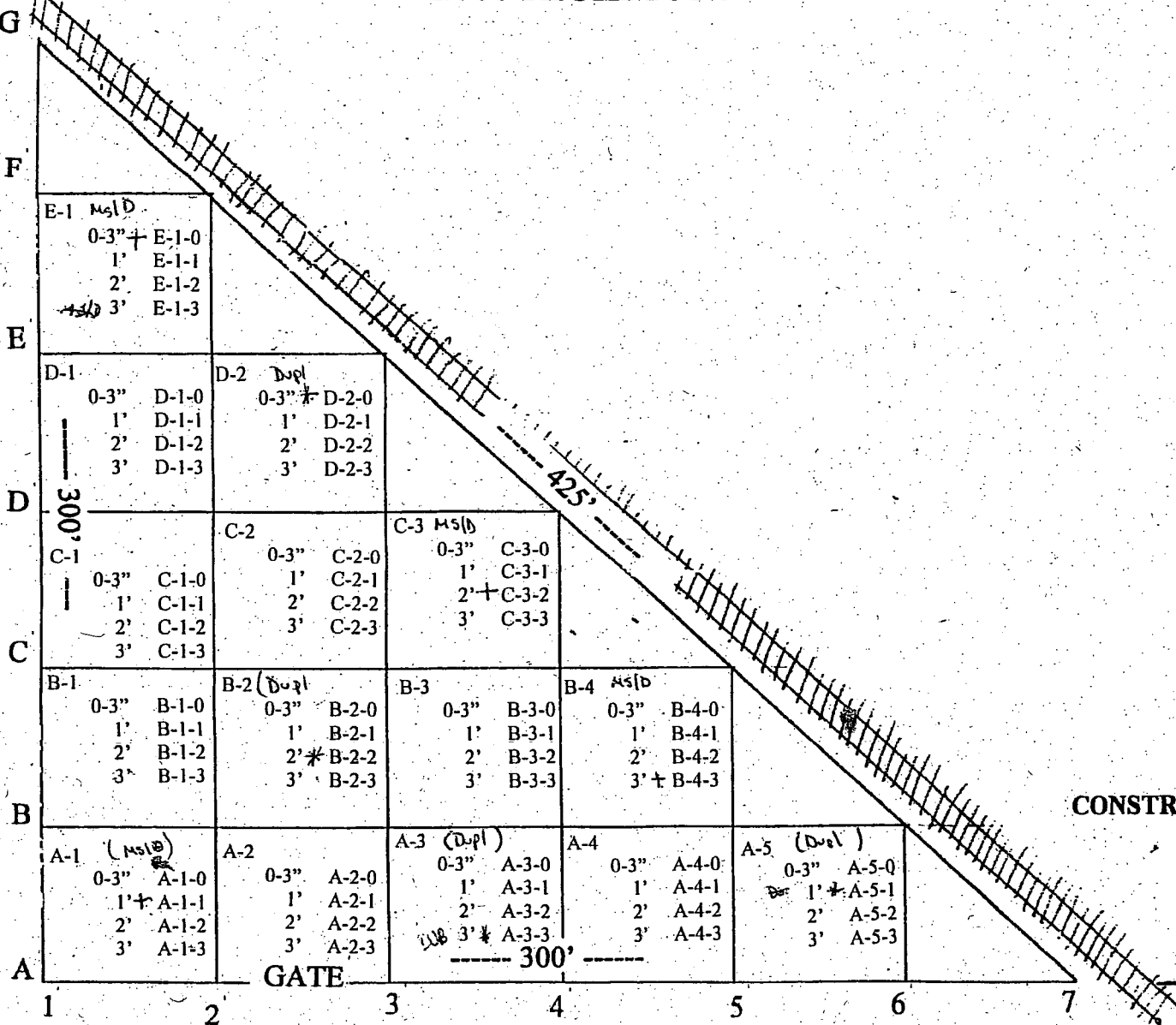


For more photos, please contact:
Jan Hagiwara, EPA Region 2, ERRD-SPB at (212) 637-4321

CONSTRUCTION
COMPANY

2000 RICHMOND TERRACE SITE

RICHMOND TERRACE



CONSTRUCTION

COMPANY

RESIDENTIAL

HOUSING

PARK AVE

* Dup
+ MS/D

NOT TO SCALE

APPENDIX B

**U.S. EPA (Environmental Protection Agency)
Environmental Response Team (ERT)**

**Standard Operating Procedure (SOP) #2006: *Sampling Equipment Decontamination*
Office of Emergency and Remedial Response (OERR)
Washington, DC.**

January 1991

1.0 SAMPLING EQUIPMENT DECONTAMINATION: SOP #2006

1.1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures at a hazardous waste site. Preventing or minimizing cross-contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel.

Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

1.2 METHOD SUMMARY

Contaminants can be physically removed from equipment, or deactivated by sterilization or disinfection. Gross contamination of equipment requires physical decontamination, including abrasive and non-abrasive methods. These include the use of brushes, air and wet blasting, and high-pressure water cleaning, followed by a wash/rinse process using appropriate cleaning solutions. Use of a solvent rinse is required when organic contamination is present.

1.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

This section is not applicable to this SOP.

1.4 INTERFERENCES AND POTENTIAL PROBLEMS

- The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment

provided that it has been verified by laboratory analysis to be analyte free.

- An untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal water treatment system for mixing of decontamination solutions.
- Acids and solvents utilized in the decontamination sequence pose the health and safety risks of inhalation or skin contact, and raise shipping concerns of permeation or degradation.
- The site work plan must address disposal of the spent decontamination solutions.
- Several procedures can be established to minimize contact with waste and the potential for contamination. For example:
 - Stress work practices that minimize contact with hazardous substances.
 - Use remote sampling, handling, and container-opening techniques when appropriate.
 - Cover monitoring and sampling equipment with protective material to minimize contamination.
 - Use disposable outer garments and disposable sampling equipment when appropriate.

1.5 EQUIPMENT/APPARATUS

- appropriate personal protective clothing
- non-phosphate detergent
- selected solvents
- long-handled brushes
- drop cloths/plastic sheeting
- trash container
- paper towels
- galvanized tubs or buckets
- tap water

- distilled/deionized water
- metal/plastic containers for storage and disposal of contaminated wash solutions
- pressurized sprayers for tap and deionized/distilled water
- sprayers for solvents
- trash bags
- aluminum foil
- safety glasses or splash shield
- emergency eyewash bottle

1.6 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions and solvents. In general, the following solvents are utilized for decontamination purposes:

- 10% nitric acid⁽¹⁾
- acetone (pesticide grade)⁽²⁾
- hexane (pesticide grade)⁽²⁾
- methanol

⁽¹⁾ Only if sample is to be analyzed for trace metals.

⁽²⁾ Only if sample is to be analyzed for organics.

1.7 PROCEDURES

As part of the health and safety plan, develop and set up a decontamination plan before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- the number, location, and layout of decontamination stations
- which decontamination apparatus is needed
- the appropriate decontamination methods
- methods for disposal of contaminated clothing, apparatus, and solutions

1.7.1 Decontamination Methods

All personnel, samples, and equipment leaving the contaminated area of a site must be decontaminated. Various decontamination methods will either physically remove contaminants, inactivate contaminants by disinfection or sterilization, or do both:

In many cases, gross contamination can be removed by physical means. The physical decontamination techniques appropriate for equipment decontamination can be grouped into two categories: abrasive methods and non-abrasive methods.

Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The following abrasive methods are available:

- **Mechanical:** Mechanical cleaning methods use brushes of metal or nylon. The amount and type of contaminants removed will vary with the hardness of bristles, length of brushing time, and degree of brush contact.
- **Air Blasting:** Air blasting is used for cleaning large equipment, such as bulldozers, drilling rigs or auger bits. The equipment used in air blast cleaning employs compressed air to force abrasive material through a nozzle at high velocities. The distance between the nozzle and the surface cleaned, as well as the pressure of air, the time of application, and the angle at which the abrasive strikes the surface, determines cleaning efficiency. Air blasting has several disadvantages: it is unable to control the amount of material removed, it can aerate contaminants, and it generates large amounts of waste.
- **Wet Blasting:** Wet blast cleaning, also used to clean large equipment, involves use of a suspended fine abrasive delivered by compressed air to the contaminated area. The amount of materials removed can be carefully controlled by using very fine abrasives. This method generates a large amount of waste.

Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off of a surface with pressure. In general, less of the equipment surface is removed using non-abrasive methods. The following non-abrasive methods are available:

- **High-Pressure Water:** This method consists of a high-pressure pump, an operator-controlled directional nozzle, and a high pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) which relates to flow rates of 20 to 140 liters per minute.
- **Ultra-High-Pressure Water:** This system produces a pressurized water jet (from 1,000 to 4,000 atm). The ultra-high-pressure spray removes tightly-adhered surface film. The water velocity ranges from 500 m/sec (1,000 atm) to 900 m/sec (4,000 atm). Additives can enhance the method. This method is not applicable for hand-held sampling equipment.

Disinfection/Rinse Methods

- **Disinfection:** Disinfectants are a practical means of inactivating infectious agents.
- **Sterilization:** Standard sterilization methods involve heating the equipment. Sterilization is impractical for large equipment.
- **Rinsing:** Rinsing removes contaminants through dilution, physical attraction, and solubilization.

1.7.2 Field Sampling Equipment Cleaning Procedures

Solvent rinses are not necessarily required when organics are not a contaminant of concern and may be eliminated from the sequence specified below. Similarly, an acid rinse is not required if analysis does not include inorganics.

1. Where applicable, follow physical removal procedures specified in section 1.7.1.
2. Wash equipment with a non-phosphate detergent solution.
3. Rinse with tap water.
4. Rinse with distilled/deionized water.
5. Rinse with 10% nitric acid if the sample will be analyzed for trace organics.

6. Rinse with distilled/deionized water.
7. Use a solvent rinse (pesticide grade) if the sample will be analyzed for organics.
8. Air dry the equipment completely.
9. Rinse again with distilled/deionized water.

Selection of the solvent for use in the decontamination process is based on the contaminants present at the site. Use of a solvent is required when organic contamination is present on-site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. An acid rinse step is required if metals are present on-site. If a particular contaminant fraction is not present at the site, the nine-step decontamination procedure listed above may be modified for site specificity. The decontamination solvent used should not be among the contaminants of concern at the site.

Table 1 on page 4 lists solvent rinses which may be required for elimination of particular chemicals. After each solvent rinse, the equipment should be air dried and rinsed with distilled/deionized water.

Sampling equipment that requires the use of plastic tubing should be disassembled and the tubing replaced with clean tubing, before commencement of sampling and between sampling locations.

1.8 CALCULATIONS

This section is not applicable to this SOP.

1.9 QUALITY ASSURANCE/ QUALITY CONTROL

One type of quality control sample specific to the field decontamination process is the rinsate blank. The rinsate blank provides information on the effectiveness of the decontamination process employed in the field. When used in conjunction with field blanks and trip blanks, a rinsate blank can detect contamination during sample handling, storage and sample transportation to the laboratory.

Table 1: Recommended Solvent Rinse for Soluble Contaminants

SOLVENT	SOLUBLE CONTAMINANTS
Water	<ul style="list-style-type: none"> • Low-chain hydrocarbons • Inorganic compounds • Salts • Some organic acids and other polar compounds
Dilute Acids	<ul style="list-style-type: none"> • Basic (caustic) compounds • Amines • Hydrazines
Dilute Bases -- for example, detergent and soap	<ul style="list-style-type: none"> • Metals • Acidic compounds • Phenol • Thiols • Some nitro and sulfonic compounds
Organic Solvents ⁽¹⁾ - for example, alcohols, ethers, ketones, aromatics, straight-chain alkanes (e.g., hexane), and common petroleum products (e.g., fuel, oil, kerosene)	<ul style="list-style-type: none"> • Nonpolar compounds (e.g., some organic compounds)

⁽¹⁾ - WARNING: Some organic solvents can permeate and/or degrade protective clothing.

A rinsate blank consists of a sample of analyte-free (i.e, deionized) water which is passed over and through a field decontaminated sampling device and placed in a clean sample container.

Rinsate blanks should be run for all parameters of interest at a rate of 1 per 20 for each parameter, even if samples are not shipped that day. Rinsate blanks are not required if dedicated sampling equipment is used.

1.10 DATA VALIDATION

This section is not applicable to this SOP.

1.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures.

Decontamination can pose hazards under certain circumstances even though performed to protect

health and safety. Hazardous substances may be incompatible with decontamination methods. For example, the decontamination solution or solvent may react with contaminants to produce heat, explosion, or toxic products. Decontamination methods may be incompatible with clothing or equipment; some solvents can permeate or degrade protective clothing. Also, decontamination solutions and solvents may pose a direct health hazard to workers through inhalation or skin contact, or if they combust.

The decontamination solutions and solvents must be determined to be compatible before use. Any method that permeates, degrades, or damages personal protective equipment should not be used. If decontamination methods pose a direct health hazard, measures should be taken to protect personnel or the methods should be modified to eliminate the hazard.

APPENDIX C

**U.S. EPA (Environmental Protection Agency)
Superfund Program Representative Sampling Guidance
OSWER Directive 9360.4-10 Interim Final EPA/540/R-95-141**

**Office of Emergency and Remedial Response (OERR)
Washington, D.C.**

December 1995.

OSWER Directive 9360.4-10
EPA 540/R-95/141
PB96-963207
December 1995

SUPERFUND PROGRAM
REPRESENTATIVE SAMPLING GUIDANCE

VOLUME 1: SOIL

Interim Final

Environmental Response Team

**Office of Emergency and Remedial Response
Office of Solid Waste and Emergency Response
U.S. Environmental Protection Agency
Washington, DC 20460**

Notice

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

The policies and procedures established in this document are intended solely for the guidance of government personnel, for use in the Superfund Program. They are not intended, and cannot be relied upon, to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. The Agency reserves the right to act at variance with these policies and procedures and to change them at any time without public notice.

For more information on Soil Sampling and Surface Geophysics procedures, refer to the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*, OSWER directive 9360.4-02, EPA/540/P-91/006. Topics covered in this compendium include Sampling Equipment Decontamination, Soil Sampling, Soil Gas Sampling, and General Surface Geophysics. The compendium describes procedures for collecting representative soil samples and provides a quick means of waste site evaluation. It also addresses the general procedures used to acquire surface geophysical data.

Questions, comments, and recommendations are welcomed regarding the *Superfund Program Representative Sampling Guidance, Volume 1 -- Soil*. Send remarks to:

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Raritan Depot - Building 18, MS-101
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Acknowledgments

This document was prepared by the U.S. EPA Committee on Representative Sampling for the Removal Program, under the direction of Mr. William A. Coakley, the Removal Program QA Coordinator of the Environmental Response Team, Emergency Response Division. Additional support was provided by the following EPA Workgroup and under U.S. EPA contract # 68-WO-0036 and U.S. EPA contract # 68-03-3482.

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1.0 INTRODUCTION

1.1 OBJECTIVE AND SCOPE

This is the first volume in a series of guidance documents that assist Superfund Program Site Managers, On-Scene Coordinators (OSCs), Remedial Project Managers (RPMs), and other field staff in obtaining representative samples at Superfund sites. The objective of representative sampling is to ensure that a sample or a group of samples accurately characterizes site conditions. This document specifically addresses representative sampling for soil. The information presented here is valid throughout the Superfund program, but focuses on the objectives of early action activities and emergency responses. Topics covered in the document include: assessing available information; selecting an appropriate sampling approach; selecting and utilizing geophysical, analytical screening, and sampling equipment; utilizing proper sample preparation techniques; incorporating suitable types and numbers of Quality Assurance/Quality Control (QA/QC) samples; and interpreting and presenting the analytical and geophysical data.

In the Superfund program, representative sample data collected during emergency responses or early actions may form the basis of remedial response. Longer, more complex responses require a variety of sampling objectives, including identifying threat, delineating sources and extent of contamination, and confirming the achievement of clean-up standards. Many important and potentially costly decisions are based on the sampling data, making it very important that OSCs and field personnel understand how accurately the sampling data characterize the actual site conditions. In keeping with this strategy, this document emphasizes analytical screening and geophysical techniques as cost effective approaches to characterize the site and to select sampling locations.

1.2 Conceptual Site Model

A conceptual site model is a useful tool for selecting sampling locations. It helps ensure that sources, pathways, and receptors throughout the site have been considered before sampling locations are chosen. The conceptual model assists the Site Manager in evaluating the interaction of different site features. Risk assessors use conceptual models to help plan for risk assessment activities. Frequently, a conceptual model is created as a site map (see Figure 1) or it may

be developed as a flow diagram which describes potential migration of contaminants to site receptors (see Appendix A).

A conceptual model follows contaminants from their sources, to pathways (e.g., air, surface water), and eventually to the assessment endpoints. Consider the following when creating a conceptual model:

- The state(s) of each contaminant and its potential mobility
- Site topographical features
- Meteorological conditions (e.g., wind direction/speed, average precipitation, temperature, humidity)
- Human/wildlife activities on or near the site

The conceptual site model on the next page is an example created for this document. The model assists in identifying the following site characteristics:

Potential Sources:

Site (waste pile); drum dump; agricultural activities

Potential Exposure Pathway (Soil):

Leachate from the waste pile or drum dump; contaminated soil from direct contact with the waste pile or drum dump; agricultural activities such as pesticide application onto cropland

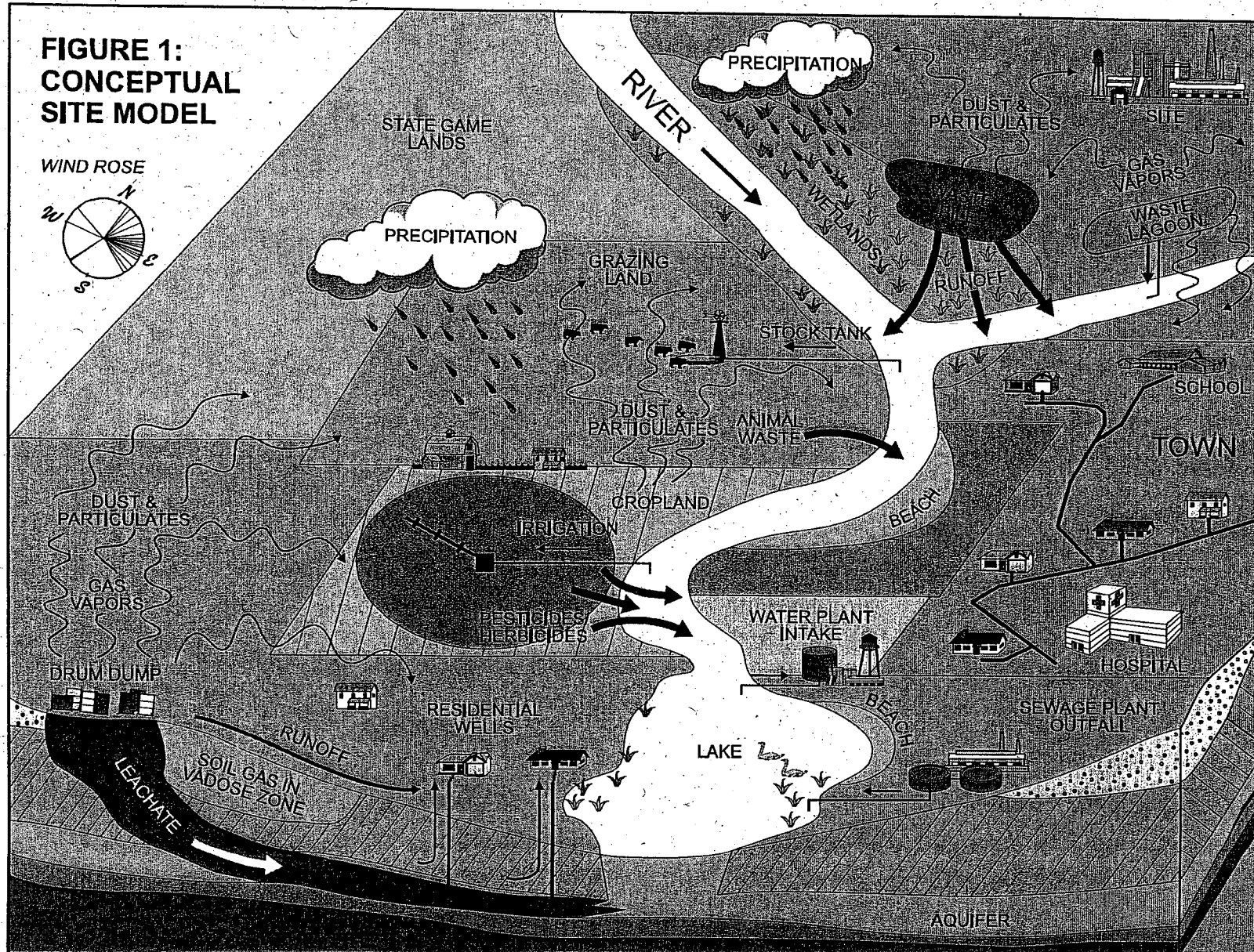
NOTE: Soil is described as an *exposure* pathway rather than a *migration* pathway because, unlike other media (e.g., air), contact between contaminated soil and a receptor is initiated by the receptor.

Potential Exposure Routes:

Ingestion -- Soil particles from the waste pile, drum dump or area of agricultural activity

Absorption/direct contact -- Soil near the waste pile, drum dump or area of agricultural activity

**FIGURE 1:
CONCEPTUAL
SITE MODEL**



Potential Receptors of Concern (and associated potential exposure routes):

Human Population

Residents/Trespassers:

Leachate into soil from the drum dump; direct contact with soil contaminated by pesticides or other agricultural activities in the cropland

Workers/Trespassers:

Leachate into soil from the waste pile; contaminated soil associated with the waste pile or agricultural activities in the cropland

Biota

Endangered/threatened species or human food chain organisms, if suspected to be in contact with an area of potentially contaminated soil

Preliminary site information may provide the identification of the contaminant(s) of concern and the level(s) of the contamination. A sampling plan should be developed based upon the selected receptors of concern and the suspected sources and pathways. The model may assist in the selection of on-site and off-site sampling locations.

1.3 REPRESENTATIVE SAMPLING OBJECTIVES

Representative sampling applies to all phases of a Superfund response action. Representative sampling objectives for soil include:

1. Establishing threat to public health or welfare or to the environment;
2. Locating and identifying potential sources of contamination;
3. Defining the extent of contamination;
4. Determining treatment and disposal options; and
5. Documenting the attainment of clean-up goals.

These objectives are discussed in detail in Section 2.5:

1.4 REPRESENTATIVE SAMPLING

Representative soil sampling ensures that a sample or group of samples accurately reflects the concentration of the contaminant(s) of concern at a given time and location. Analytical results from representative samples reflect the variation in pollutant presence and concentration throughout a site.

This document concentrates on the variables that are introduced in the field -- namely, those that relate to the site-specific conditions, the sampling design approach, and the techniques for collection and preparation of samples. The following variables affect the representativeness of samples and subsequent measurements:

- Geological variability -- Regional and local variability in the mineralogy of rocks and soils, the buffering capacity of soils, lithologic permeability, and in the sorptive capacity of the vadose zone.
- Contaminant concentration variability -- Variations in the contaminant concentrations throughout the site.
- Collection and preparation variability -- Deviations in analytical results attributable to bias introduced during sample collection, preparation, and transportation (for analysis).
- Analytical variability -- Deviations in analytical results attributable to the manner in which the sample was stored, prepared, and analyzed by the on-site or off-site laboratory. Although analytical variability cannot be corrected through representative sampling, it can falsely lead to the conclusion that error is due to sample collection and handling procedures.

1.5 EXAMPLE SITE

An example site, presented at the end of each chapter, illustrates the development of a representative soil sampling plan that meets Superfund Program objectives for early actions or emergency responses.



2.0 SAMPLING DESIGN

2.1 INTRODUCTION

The following procedures are recommended for developing a sound sampling design. Many steps can be performed simultaneously, and the sequence is not rigid.

- Review existing historical site information;
- Perform a site reconnaissance;
- Evaluate potential migration pathways and receptors;
- Determine the sampling objectives;
- Establish the data quality objectives;
- Utilize screening techniques;
- Select parameters for which to be analyzed;
- Select an appropriate sampling approach; and
- Determine the locations to be sampled.

Real-time analytical screening techniques can be used throughout the removal action. The results can be used to modify the site sampling plan as the extent of contamination becomes known.

2.2 HISTORICAL DATA REVIEW

Unless the site is considered a classic emergency, every effort should be made to first thoroughly review relevant site information. An historical data review examines past and present site operations and disposal practices, providing an overview of known and potential site contamination and other site hazards. Sources of information include federal, state and local officials and files (e.g., site inspection reports and legal actions), deed or title records, current and former facility employees, potentially responsible parties, local residents, and facility records or files. For any previous sampling efforts, obtain information regarding sample locations (on maps, if possible), matrices, methods of collection and analysis, and relevant contaminant concentrations. Assess the reliability and usefulness of existing analytical data. Even data which are not substantiated by documentation or QA/QC controls may still be useful.

Collect information that describes any specific chemical processes used on site, as well as descriptions of raw materials used, products and wastes, and waste storage and disposal practices. Whenever possible, obtain site maps, facility blueprints, and historical aerial photographs, detailing past and present storage, process, and waste disposal locations. The local Agricultural Extension Agent, a Soil Conservation Service (SCS) representative, has information on soil types and drainage patterns. County property and tax records, and United States Geological Survey (USGS) topographic maps are also useful sources of site and regional information.

2.3 SITE RECONNAISSANCE

A site reconnaissance, conducted either prior to or in conjunction with sampling, is invaluable to assess site conditions, to evaluate areas of potential contamination, to evaluate potential hazards associated with sampling, and to develop a sampling plan. During the reconnaissance, fill data gaps left from the historical review by:

- Interviewing local residents, and present or past employees about site-related activities;
- Researching facility files or records (where records are made accessible by owner/operator);
- Performing a site entry, utilizing appropriate personal protective equipment and instrumentation. Observe and photo-document the site; note site access routes; map process and waste disposal areas such as landfills, lagoons, and effluent pipes; inventory site wastes; and map potential transport routes such as ponds, streams, and irrigation ditches. Note topographic and structural features, dead animals and dead or stressed vegetation, potential safety hazards, and visible label information from drums, tanks, or other containers found on the site.

2.4 MIGRATION PATHWAYS AND RECEPTORS

The historical review and site visit are the initial steps in defining the source areas of contamination which could pose a threat to human health and the environment. This section addresses how to delineate the spread of contamination away from the source areas. Included are pollutant migration pathways and

the routes by which persons or the environment may be exposed to the on-site chemical wastes.

2.4.1 Migration Pathways and Transport Mechanisms

Migration pathways are routes by which contaminants have moved or may be moved away from a contamination source. Pollutant migration pathways may include man-made pathways, surface drainage, vadose zone transport, and wind dispersion. Human activity (such as foot or vehicular traffic) also transports contaminants away from a source area. These five transport mechanisms are described below.

- **Man-made pathways** -- A site located in an urban setting has the following man-made pathways which can aid contaminant migration: storm and sanitary sewers, drainage culverts, sumps and sedimentation basins, French drain systems, and underground utility lines.
- **Surface drainage** -- Contaminants can be adsorbed onto sediments, suspended independently in the water column, or dissolved in surface water runoff and be rapidly carried into drainage ditches, streams, rivers, ponds, lakes, and wetlands. Consider prior surface drainage routes; historical aerial photographs can be invaluable for delineation of past surface drainage patterns. An historical aerial photograph search can be requested through the EPA Regional Remote Sensing Coordinator.
- **Vadose zone transport** -- Vadose zone transport is the vertical or horizontal movement of water and of soluble and insoluble contaminants within the unsaturated zone of the soil profile. Contaminants from a surface source or a leaking underground storage tank can percolate through the vadose zone and be adsorbed onto subsurface soil or reach groundwater.
- **Wind dispersion** -- Contaminants deposited over or adsorbed onto soil may migrate from a waste site as airborne particulates. Depending on the particle-size distribution and associated settling rates, these particulates may be deposited downwind or remain suspended, resulting in contamination of surface soils and/or exposure of nearby populations.
- **Human and animal activity** -- Foot and vehicular traffic of facility workers, response personnel, and trespassers can move contaminants away from a source. Animal burrowing, grazing, and

migration can also contribute to contaminant migration.

2.4.2 Receptors

Once the migration pathways have been determined, identify all receptors (i.e., potentially affected human and environmental populations) along these pathways. Human receptors include on-site and nearby residents and workers. Note the attractiveness and accessibility of site wastes (including contaminated soil) to children and other nearby residents. Environmental receptors include Federal- or state-designated endangered or threatened species, habitats for these species, wetlands, and other Federal- and state-designated wilderness, critical, and natural areas.

2.5 SOIL REPRESENTATIVE SAMPLING OBJECTIVES

Collect samples if any of the following sampling objectives in the scope of the project are not fulfilled by existing data.

1. **Establishing Threat to Public Health or Welfare or to the Environment** -- The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the National Contingency Plan (NCP) establish the funding mechanism and authority which allow the OSC to activate a Federal removal action. The OSC must establish (often with sampling) that the site poses a threat to public health or welfare or to the environment.
2. **Locating and Identifying Potential Sources of Contamination** -- Sample to identify the locations and sources of contamination. Use the results to formulate removal priorities, containment and clean-up strategies, and cost projections.
3. **Defining the Extent of Contamination** -- Where appropriate, sample to assess horizontal and vertical extent of contaminant concentrations. Use the results to determine the site boundaries (i.e., extent of contamination), define clean areas, estimate volume of contaminated soil, establish a clearly defined removal approach, and assess removal costs and timeframe.
4. **Determining Treatment and Disposal Options** -- Sample to characterize soil for in situ or other on-site treatment, or excavation and off-site treatment or disposal.

5. Documenting the Attainment of Clean-up Goals -- During or following a site cleanup, sample to determine whether the goals were achieved, and to delineate areas requiring further treatment or excavation when appropriate.

2.6 DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) state the level of uncertainty that is acceptable from data collection activities. DQOs also define the data quality necessary to make a certain decision. Consider the following when establishing DQOs for a particular project:

- Decision(s) to be made or question(s) to be answered;
- Why environmental data are needed and how the results will be used;
- Time and resource constraints on data collection;
- Descriptions of the environmental data to be collected;
- Applicable model or data interpretation method used to arrive at a conclusion;
- Detection limits for analytes of concern; and
- Sampling and analytical error.

In addition to these considerations, the quality assurance components of precision, accuracy (bias), completeness, representativeness, and comparability should also be considered. Quality assurance components are defined as follows:

- Precision -- measurement of variability in the data collection process.
- Accuracy (bias) -- measurement of bias in the analytical process. The term "bias" throughout this document refers to the QA/QC accuracy component.
- Completeness -- percentage of sampling measurements which are judged to be valid.
- Representativeness -- degree to which sample data accurately and precisely represent the characteristics of the site contaminants and their concentrations.

- Comparability -- evaluation of the similarity of conditions (e.g., sample depth, sample homogeneity) under which separate sets of data are produced.

Quality assurance/quality control (QA/QC) objectives are discussed further in Chapter 5.

2.7 ANALYTICAL SCREENING AND GEOPHYSICAL TECHNIQUES

There are two primary types of analytical data which can be generated during sampling: laboratory analytical data and analytical screening data. Analytical screening techniques (e.g., using a photoionization detector (PID), portable X-ray fluorescence (XRF) unit, and hazard categorization kits) provide real-time or direct reading capabilities. These screening methods can narrow the possible groups or classes of chemicals for laboratory analysis and are effective and economical for gathering large amounts of site data. Once an area is identified using screening techniques, a subset of samples can be sent for laboratory analysis to substantiate the screening results. Under a limited sampling budget, analytical screening (with laboratory confirmation) will generally result in more analytical data from a site than will sampling for off-site laboratory analysis alone. To minimize the potential for false negatives (not detecting on-site contamination), use only those analytical screening methods which provide detection limits below applicable action levels. It should be noted, that some analytical screening methods which do not achieve detection limits below site action levels can still detect grossly contaminated areas, and can be useful for some sampling events.

Geophysical techniques may also be utilized during a removal action to help depict locations of any potential buried drums or tanks, buried waste, and disturbed areas. Geophysical techniques include ground penetrating radar (GPR), magnetometry, electromagnetic conductivity (EM) and resistivity surveys.

2.8 PARAMETERS FOR ANALYSIS

If the historical data review yields little information about the types of waste on site, use applicable screening methods to narrow the parameters for analysis by ruling out the presence of high concentrations of certain contaminants. If the screening results are inconclusive, send a subset of samples from the areas of concern for a full chemical

characterization by an off-site laboratory. It is advised that samples from known or suspected source areas be sent to the laboratory for a full chemical characterization so that all contaminants of concern can be identified (even at low detection levels), and future sampling and analysis can then focus on those substances.

Away from source areas, select a limited number of indicator parameters (e.g., lead, PAHs) for analysis based on the suspected contaminants of concern. This will result in significant cost savings over a full chemical characterization of each sample. Utilize EPA-approved methodologies and sample preparation, where possible, for all requested off-site laboratory analyses.

2.9 SAMPLING APPROACHES

Selecting sampling locations for screening or laboratory analysis entails choosing the most appropriate sampling approach. Representative sampling approaches include **judgmental, random, stratified random, systematic grid, systematic random, search, and transect sampling**. A representative sampling plan may combine two or more of these approaches. Each approach is defined below.

2.9.1 Judgmental Sampling

Judgmental sampling is the subjective selection of sampling locations at a site, based on historical information, visual inspection, and on best professional judgment of the sampling team. Use judgmental sampling to identify the contaminants present at areas having the highest concentrations (i.e., worst-case conditions). Judgmental sampling has no randomization associated with the sampling strategy, precluding any statistical interpretation of the sampling results.

2.9.2 Random Sampling

Random sampling is the arbitrary collection of samples within defined boundaries of the area of concern. Choose random sample locations using a

random selection procedure (e.g., using a random number table). Refer to U.S. EPA, 1984a, for a random number table. The arbitrary selection of sampling points requires each sampling point to be selected independent of the location of all other points, and results in all locations within the area of concern having an equal chance of being selected. Randomization is necessary in order to make probability or confidence statements about the sampling results. The key to interpreting these probability statements is the assumption that the site is homogeneous with respect to the parameters being monitored. The higher the degree of heterogeneity, the less the random sampling approach will adequately characterize true conditions at the site. Because hazardous waste sites are very rarely homogeneous, other statistical sampling approaches (discussed below) provide ways to subdivide the site into more homogeneous areas. These sampling approaches may be more appropriate for removal activities than random sampling. Refer to U.S. EPA, February 1989, pages 5-3 to 5-5 for guidelines on selecting sample coordinates for random sampling. Figure 2 illustrates a random sampling approach.

2.9.3 Stratified Random Sampling

Stratified random sampling often relies on historical information and prior analytical results (or screening data) to divide the sampling area into smaller areas called strata. Each strata is more homogeneous than the site is as a whole. Strata can be defined based on various factors, including: sampling depth, contaminant concentration levels, and contaminant source areas. Place sample locations within each of these strata using random selection procedures. Stratified random sampling imparts some control upon the sampling scheme but still allows for random sampling within each stratum. Different sampling approaches may also be selected to address the different strata at the site. Stratified random sampling is a useful and flexible design for estimating the pollutant concentration within each depth interval or area of concern. Figure 3 illustrates a stratified random sampling approach where strata are defined based on depth. In this example, soil coring devices are used to collect samples from given depths at randomly selected locations within the strata.

Figure 2: Random Sampling

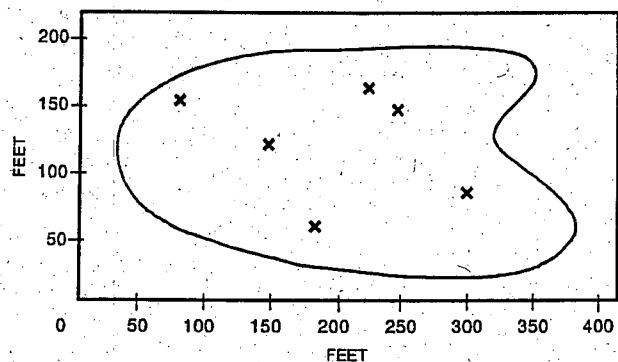


Figure 3: Stratified Random Sampling

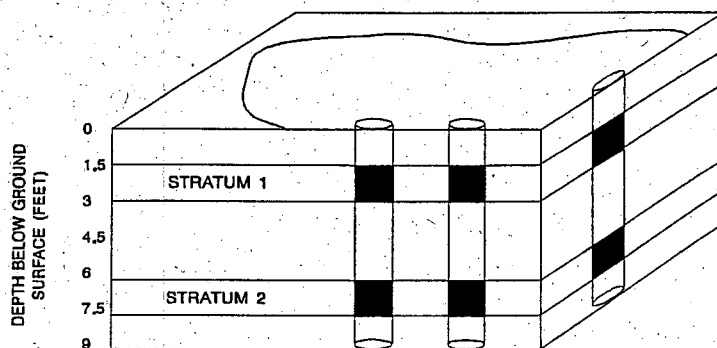
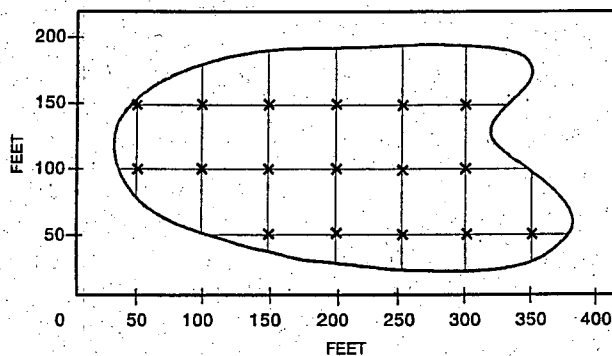


Figure 4: Systematic Grid Sampling



KEY
 x SELECTED SAMPLE LOCATION

After U.S. EPA, February 1989

2.9.4 Systematic Grid Sampling

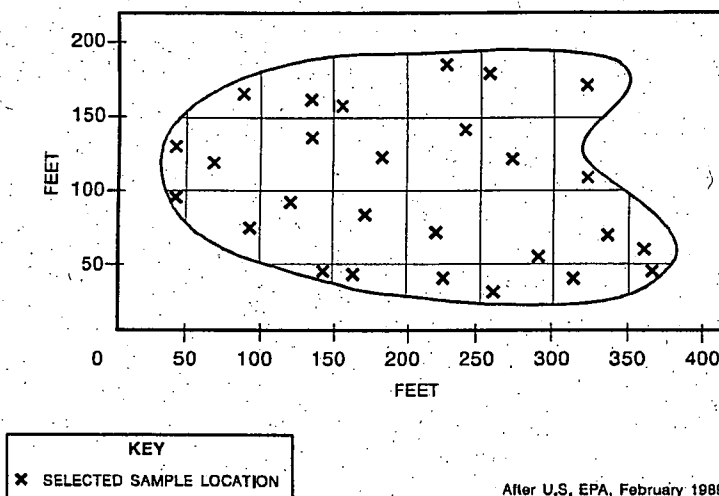
Systematic grid sampling involves subdividing the area of concern by using a square or triangular grid and collecting samples from the nodes (intersections of the grid lines). Select the origin and direction for placement of the grid using an initial random point. From that point, construct a coordinate axis and grid over the whole site. The distance between sampling locations in the systematic grid is determined by the size of the area to be sampled and the number of samples to be collected.

Systematic grid sampling is often used to delineate the extent of contamination and to define contaminant concentration gradients. Refer to U.S. EPA February 1989, pages 5-5 to 5-12, for guidelines on selection of sample coordinates for systematic grid sampling. Figure 4 illustrates a systematic grid sampling approach.

2.9.5 Systematic Random Sampling

Systematic random sampling is a useful and flexible design for estimating the average pollutant concentration within grid cells. Subdivide the area of concern using a square or triangular grid (as described in Section 2.9.4) then collect samples from within each cell using random selection procedures. Systematic random sampling allows for the isolation of cells that may require additional sampling and analysis. Figure 5 illustrates a systematic random sampling approach.

Figure 5: Systematic Random Sampling



2.9.6 Search Sampling

Search sampling utilizes either a systematic grid or systematic random sampling approach to search for areas where contaminants exceed applicable clean-up standards (**hot spots**). The number of samples and the grid spacing are determined on the basis of the acceptable level of error (i.e., the chance of missing a hot spot). Search sampling requires that assumptions be made about the size, shape, and depth of the hot spots. As illustrated in Figure 6, the smaller and/or narrower the hot spots are, the smaller the grid spacing must be in order to locate them. Also, the smaller the acceptable error of missing hot spots is, the smaller the grid spacing must be. This, in effect, means collecting more samples.

Once grid spacing has been selected, the probability of locating a hot spot can be determined. Using a systematic grid approach, Table 1 lists approximate probabilities of missing an elliptical hot spot based on the grid method chosen as well as the dimensions of the hot spot. The lengths of the long and short axes (L and S) are represented as a percentage of the grid spacing chosen. The triangular grid method consistently shows lower probabilities of missing a hot spot in comparison to the block grid method. Table 1 can be used in two ways. If the acceptable probability of missing a hot spot is known, then the size of the hot spot which can be located at that probability level can be determined. Conversely, if the approximate size of the hot spot is known, the probability of locating it can be determined.

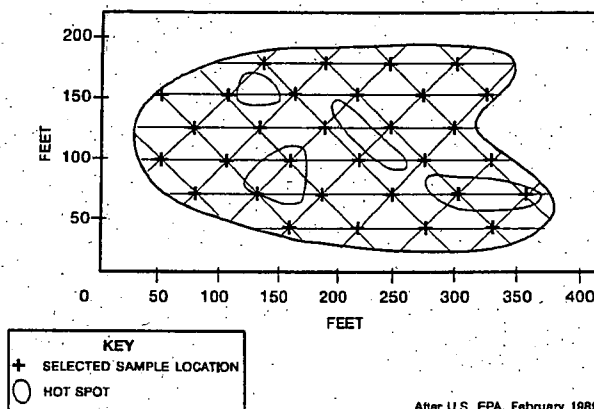
For example, suppose the block grid method is chosen with a grid spacing of 25 feet. The OSC is willing to accept a 10% chance of missing an elliptical hot spot. Using Table 1, there would be a 90% probability of locating an elliptical hot spot with L equal to 90% of the grid spacing chosen and S equal to 40% of the grid spacing chosen. Therefore the smallest elliptical hot spot which can be located would have a long axis $L = 0.90 \times 25\text{ ft.} = 22.5\text{ ft.}$ and a short axis $S = 0.40 \times 25\text{ ft.} = 10\text{ ft.}$

Similarly, if the approximate size of the hot spot being searched for is known, then the probability of missing that hot spot can be determined. For example, if a triangular grid method was chosen with a 25 foot grid spacing and the approximate shape of the hot spot is known, and L is approximately 15 feet or 60% of the grid spacing, and S is approximately 10 feet or 40% of the grid spacing, then there is approximately a 15% chance of missing a hot spot of this size and shape.

2.9.7 Transect Sampling

Transect sampling involves establishing one or more transect lines across the surface of a site. Collect samples at regular intervals along the transect lines at the surface and/or at one or more given depths. The length of the transect line and the number of samples to be collected determine the spacing between sampling points along the transect. Multiple transect lines may be parallel or non-parallel to one another. If the lines are parallel, the sampling objective is sim-

Figure 6: Search Sampling



After U.S. EPA, February 1988

Table 1: Probability of Missing an Elliptical Hot Spot

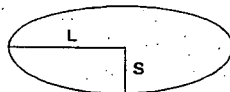
LENGTH OF SHORT AXIS AS A PERCENTAGE OF GRID SPACING

LENGTH OF LONG AXIS AS A PERCENTAGE OF GRID SPACING

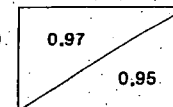
	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
10%	0.97 0.95									
20%	0.95 0.92	0.88 0.85								
30%	0.92 0.87	0.83 0.78	0.72 0.66							
40%	0.88 0.85	0.75 0.71	0.65 0.55	0.50 0.41						
50%	0.85 0.82	0.69 0.63	0.54 0.44	0.38 0.27	0.21 0.08					
60%	0.80 0.80	0.62 0.58	0.45 0.35	0.27 0.15	0.12 0.03	0.06 0.0				
70%	0.77 0.77	0.56 0.54	0.38 0.29	0.18 0.12	0.07 0.01	0.03 0.0	0.0 0.0			
80%	0.75 0.75	0.54 0.50	0.32 0.23	0.12 0.08	0.05 0.0	0.0 0.0	0.0 0.0	0.0 0.0		
90%	0.72 0.72	0.51 0.45	0.30 0.21	0.10 0.06	0.03 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	
100%	0.70 0.66	0.45 0.37	0.24 0.18	0.08 0.04	0.01 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0

From tables in Gilbert, 1987

L=length of long side
S=length of short side



BLOCK GRID



TRIANGULAR GRID

ilar to systematic grid sampling. A primary benefit of transect sampling over systematic grid sampling is the ease of establishing and relocating individual transect lines versus an entire grid. Transect sampling is often used to delineate the extent of contamination and to define contaminant concentration gradients. It is also used, to a lesser extent, in compositing sampling schemes. For example, a transect sampling approach might be used to characterize a linear feature such as a drainage ditch. A transect line is run down the center of the ditch, along its full length. Sample aliquots are collected at regular intervals along the transect line and are then composited. Figure 7 illustrates transect sampling.

Table 2 summarizes the various representative sampling approaches and ranks the approaches from most to least suitable, based on the sampling objective. Table 2 is intended to provide general guidelines, but it cannot cover all site-specific conditions encountered.

2.10 SAMPLING LOCATIONS

Once a sampling approach has been selected, the next step is to select sampling locations. For statistical (non-judgmental) sampling, careful placement of each sampling point is important to achieve representativeness.

Factors such as the difficulty in collecting a sample at a given point, the presence of vegetation, or discoloration of the soil could bias a statistical sampling plan.

Sampling points may be located with a variety of methods. A relatively simple method for locating

random points consists of using either a compass and a measuring tape, or pacing, to locate sampling points with respect to a permanent landmark, such as a survey marker. Then plot sampling coordinates on a map and mark the actual sampling points for future reference. Where the sampling design demands a greater degree of precision, locate each sample point by means of a survey. After sample collection, mark each sample point with a permanent stake so that the survey team can identify all the locations.

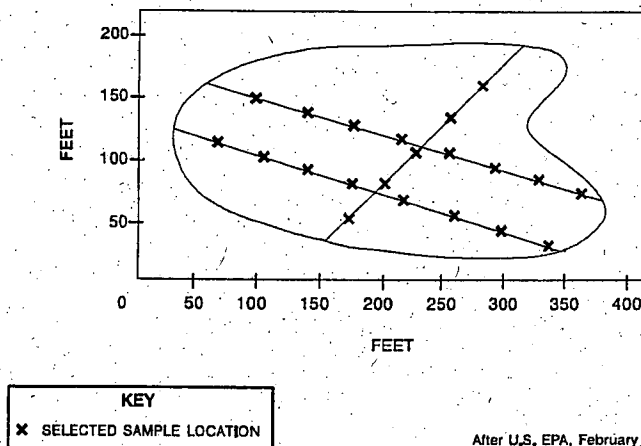
2.11 EXAMPLE SITE

2.11.1 Background Information



The ABC Plating Site is located in Carroll County, Pennsylvania, approximately 1.5 miles north of the town of Jonesville (Figure 8). The site covers approximately 4 acres, and operated as an electroplating facility from 1947 to 1982. During its years of operation, the company plated automobile and airplane parts with chromium, nickel, and copper. Cyanide solutions were used in the plating process. ABC Plating deposited electroplating wastes into two shallow surface settling lagoons in the northwest sector of the site. The county environmental health department was attempting to enforce cleanup by the site owner, when, in early 1982, a fire on site destroyed most of the process building. The owner then abandoned the facility and could not be located by enforcement and legal authorities. The county contacted EPA for an assessment of the site for a possible response.

Figure 7: Transect Sampling



After U.S. EPA, February, 1989

Table 2: Representative Sampling Approach Comparison

SAMPLING OBJECTIVE	SAMPLING APPROACH						
	JUDGEMENTAL	RANDOM	STRATIFIED RANDOM	SYSTEMATIC GRID	SYSTEMATIC RANDOM	SEARCH	TRANSECT
ESTABLISH THREAT	1	4	3	2 ^a	3	3	2
IDENTIFY SOURCES	1	4	2	2 ^a	3	2	3
DELINEATE EXTENT OF CONTAMINATION	4	3	3	1 ^b	1	1	1
EVALUATE TREATMENT & DISPOSAL OPTIONS	3	3	1	2	2	4	2
CONFIRM CLEANUP	4	1 ^c	3	1 ^b	1	1	1 ^d

1 - PREFERRED APPROACH

2 - ACCEPTABLE APPROACH

3 - MODERATELY ACCEPTABLE APPROACH

4 - LEAST ACCEPTABLE APPROACH

a - SHOULD BE USED WITH FIELD ANALYTICAL SCREENING

b - PREFERRED ONLY WHERE KNOWN TRENDS ARE PRESENT

c - ALLOWS FOR STATISTICAL SUPPORT OF CLEANUP VERIFICATION IF SAMPLING OVER ENTIRE SITE

d - MAY BE EFFECTIVE WITH COMPOSTING TECHNIQUE IF SITE IS PRESUMED TO BE CLEAN

2.11.2 Historical Data Review and Site Reconnaissance

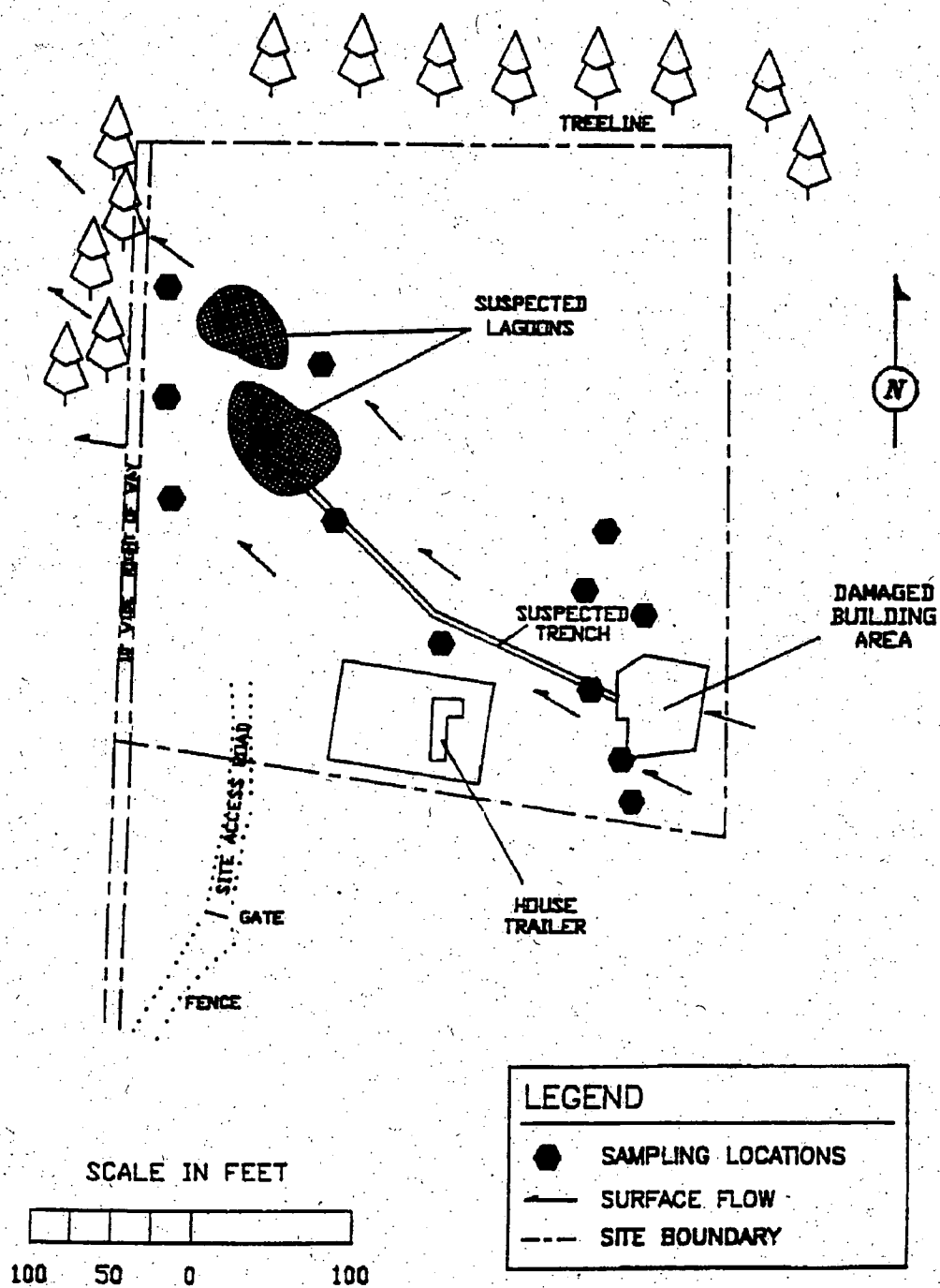
The EPA On-Scene Coordinator (OSC) reviewed the county site file, finding that in 1974, the owner was cited for violating the Clean Streams Act and for storing and treating industrial waste without a permit. The owner was ordered to file a site closure plan and to remediate the storage lagoons. The owner, however, continued operations and was then ordered to begin remediation in 90 days or be issued a cease and desist order. Soon after, a follow-up inspection revealed that the lagoons had been backfilled without removing the waste.

The OSC and response contractor arrived on site to interview local officials, fire department officers, neighboring residents (including a past facility employee), and county representatives, regarding site

operating practices and other site details. A past employee sketched facility process features on a map which was obtained from the county (Figure 8). The features included two settling lagoons and a feeder trench which transported plating wastes from the process building to the lagoons. The OSC obtained copies of aerial photographs of the site area from the district office of the U.S. Soil Conservation Service. The county also provided the OSC with copies of all historical site and violation reports.

The OSC and response contractor made a site entry utilizing appropriate personal protective equipment and instrumentation. They observed 12 vats, likely containing plating solutions, on a concrete pad where the original facility building once stood.

Figure 8: Site Sketch and Phase I Soil Sampling Locations
ABC Plating Site



Measurements of pH ranged from 1 to 11. In addition, 50 drums and numerous smaller containers (some on the concrete pad, others sitting directly on the ground) were leaking and bulging, due to the fire. The response contractor noted many areas of stained soil, which indicated container leakage, poor waste handling practices, and possible illegal dumping of wastes.

2.11.3 Identification of Migration Pathways, Transport Mechanisms and Receptors

During the site entry, the OSC noted that several areas were devoid of vegetation, threatening wind erosion which could transport heavy metal- and cyanide-contaminated soil particulates off site. These particulates could be deposited on residential property downwind or be inhaled by nearby residents.

Erosion gullies located on site indicated soil erosion and fluvial transport due to storms. Surface drainage sloped towards the northwest. The response contractor observed stressed and discolored vegetation immediately off site, along the surface drainage route. Surface drainage of heavy metals and cyanide was a direct contact hazard to local residents. Further downgradient, runoff enters an intermittent tributary of Little Creek. Little Creek in turn feeds Barker Reservoir, the primary water supply for the City of Jonesville and neighboring communities, which are located 2.5 miles downgradient of the site. The site entry team observed that the site was not secure and there were signs of trespass (confirming a neighbor's claim that children play at the facility). These activities could lead to direct contact with cyanide and heavy metal contaminants, in addition to the potential for chemical burns from direct contact with strong acids and bases.

Information obtained from the historical data review and site reconnaissance was used to create a site-specific conceptual model. Sources (e.g., vats, drums), pathways (e.g., gullies) and potential receptors (e.g., local residents) were detailed on a map to assist the selection of sampling approaches, objectives, and locations.

2.11.4 Sampling Objectives

The OSC selected three specific sampling objectives, as follows:

- Phase 1 -- Determine whether a threat to public health, welfare, and the environment exists. Identify sources of contamination to support an immediate CERCLA-funded activation for containment of contaminants and security fencing.
- Phase 2 -- Define the extent of contamination at the site and adjacent residential properties. Estimate the volume of contaminated soil and the associated removal costs.
- Phase 3 -- After excavation (or treatment), document the attainment of clean-up goals. Assess that cleanup was completed to the selected level.

2.11.5 Selection of Sampling Approaches

The OSC selected a judgmental sampling approach for Phase 1. Judgmental sampling supports the Action Memorandum process by best defining on site contaminants in the worst-case scenario in order to evaluate the threat to human health, welfare, and the environment. Threat is typically established using a relatively small number of samples (less than 20) collected from source areas, or suspected contaminated areas based on the historical data review and site reconnaissance. For this site, containerized wastes were screened to categorize the contents and to establish a worst-case waste volume, while soil samples were collected to demonstrate whether a release had already occurred.

For Phase 2, a stratified systematic grid design was selected to define the extent of contamination. The grid can accommodate analytical screening and geophysical surveys and allow for contaminated soil excavation on a cell-by-cell basis. Based on search sampling conducted at similar sites, the hot spots being searched for were assumed to be elliptical in shape and 45 feet by 20 feet in size. Under these assumptions, a block grid, with a 50 foot grid spacing, was selected. This grid size ensured a no more than 10% probability of missing a hot spot (see Table 1). The grid was extended to adjacent residential properties when contaminated soil was identified at grid points near the boundary of the site.

Phase 3 utilized a systematic grid sampling approach to confirm the attainment of clean-up goals. Following cleanup, analytical screening was conducted on excavated soil areas using a

transportable X-ray fluorescence (XRF) unit mounted in a trailer (mobile laboratory instrument). Based on the results, each area was documented as clean, or was excavated to additional depth, as necessary.

2.11.6 Analytical Screening, Geophysical Techniques, and Sampling Locations

During Phase 1 operations, containerized wastes were screened using hazard categorization techniques to identify the presence of acids, bases, oxidizers, and flammable substances. Following this procedure, photoionization detector (PID) and flame ionization detector (FID) instruments, a radiation meter, and a cyanide monitor were used to detect the presence of volatile organic compounds, radioactive substances, and cyanide, respectively, in the containerized wastes. Phase 1 screening indicated the presence of strong acids and bases and the absence of volatile organic compounds. The response contractor collected a total of 12 surface soil samples (0-3 inches) during this phase and sent them to a laboratory for analysis. The soil sampling locations included stained soil areas, erosion channels and soil adjacent to leaking containers. Background samples were not collected during Phase 1 because they were unnecessary for activating funding. Phase 1 sampling locations are shown in Figure 8. Based on Phase 1 analytical results, consultation with a Regional EPA toxicologist and with the Agency for Toxic Substances and Disease Registry (ATSDR), an action level of 100 ppm for chromium was selected for cleanup.

During Phase 2 sampling activities, the OSC used a transportable XRF unit installed in an on-site trailer to screen samples for total chromium in order to limit the number of samples to be sent for off-site laboratory analysis. The transportable XRF (rather than a portable unit) was selected for analytical screening to accommodate the 100 ppm action level for chromium. Sampling was performed at all grid nodes at the surface (0-4 inches) and subsurface (36-40 inches) (Figure 9). The 36-40 inch depth was selected based on information obtained from county reports and local interviews which indicated the lagoon wastes were approximately 3 feet below ground surface. The samples were homogenized and sieved (discussed in Chapter 4), then screened for chromium using the XRF. The surface and subsurface samples from areas downgradient of the original facility (21 grid nodes) and three upgradient (background) locations were sent for off-site laboratory analysis following XRF

screening. The analytical results from these samples allowed for site-specific calibration of the XRF unit. Once grid nodes with a contamination level greater than the selected action level were located, composite samples were collected from each adjoining cell. Surface aliquots were collected and then composited, sieved, thoroughly homogenized, and screened using the XRF to pinpoint contaminated cells. Additionally, four subsurface aliquots were collected at the same locations as the surface aliquots. They were also composited, sieved, thoroughly homogenized, and screened using the XRF. Figure 10 illustrates a Phase 2 sampling grid cell diagram. Based on the XRF data, each adjoining cell was either identified as clean (below action level), or designated for excavation (at or above action level).

For Phase 3 sampling, cleanup was confirmed by collecting and compositing four aliquots from the surface of each grid cell excavated during Phase 2. The surface composites were then screened (as in Phase 2), using the transportable XRF. Ten percent of the screened samples were also sent to an off-site laboratory for confirmatory sampling. Based on the Phase 3 screening and sampling results, each cell was documented as clean, or, excavated to additional depth, as necessary.

During Phase 2, the OSC conducted ground penetrating radar (GPR) and electromagnetic conductivity (EM) geophysical surveys to help delineate the buried trench and lagoon areas along with any other waste burial areas. The GPR survey was run along the north-south grid axis across the suspected locations of the trench and lagoons. Several structural discontinuities, defining possible disturbed areas, were detected. One anomaly corresponded with the suspected location and orientation of the feeder trench. Several discontinuities were identified in the suspected lagoon areas; however, the data did not conclusively pinpoint precise locations. This could be due to a disturbance of that area during the backfilling process by the PRP. The GPR survey is illustrated in Figure 11.

Figure 9: Soil Sampling and SRF Screening Locations
ABC Plating Site

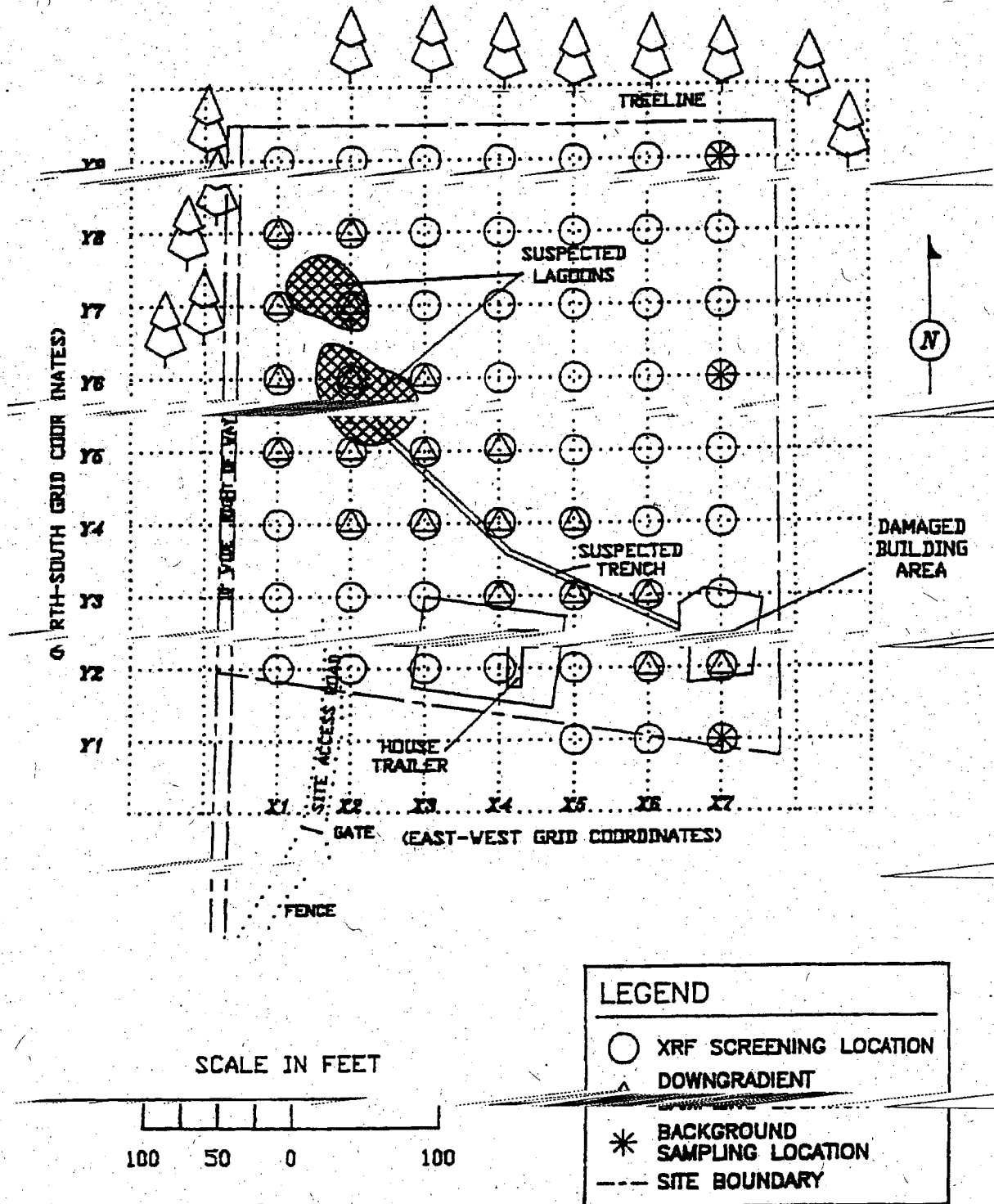
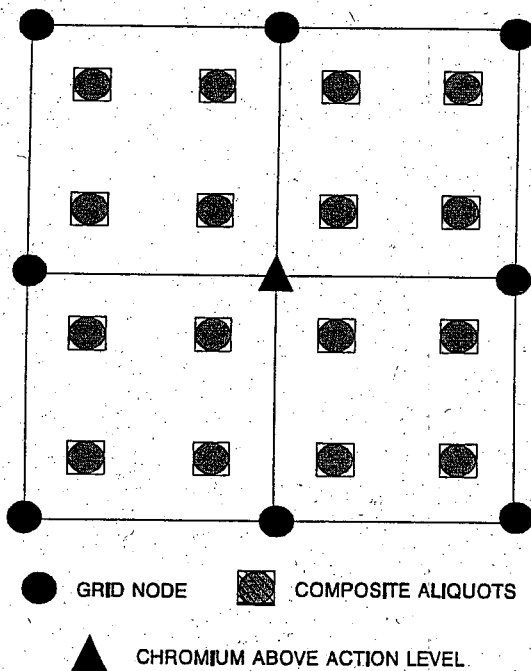


Figure 10: Phase 2 Sampling Grid Cell Diagram*



* Surface samples should be taken over a minimum area of one square foot. Sampling areas for depth sampling are limited by the diameter of the sampling equipment (e.g., auger, split spoon, or coring devices).

For the comprehensive EM survey, the original 50 foot grid spacing was decreased to 25 feet along the north-south grid axis. The EM survey was run along the north-south axes and readings were obtained at the established grid nodes. The EM survey was utilized throughout the site to detect the presence of buried metal objects (e.g., buried pipe leading to the lagoons), and potential subsurface contaminant plumes. The EM survey identified several high conductivity anomalies: the suspected feeder trench location, part of the lagoon area, and a small area west of the process building (Figure 12), which could have been an illegal waste dumping area. Several areas of interference were encountered due to the presence of large metal objects at the surface (a dumpster, surface vats and a junk car).

2.11.7 Parameters for Analysis

During Phase 1 sampling activities, full priority pollutant metals and total cyanide analyses were conducted on all samples. Since Phase 1 samples were collected from the areas of highest suspected contaminant concentration (i.e., sources and drainage pathways), Phase 2 samples were run for total chromium and cyanide, the only analytes detected during the Phase 1 analyses. During Phase 3, the samples sent to the laboratory for definitive analysis were analyzed for total chromium and cyanide. Throughout the removal, it was not possible to screen soils on site for cyanide, therefore the OSC requested laboratory cyanide analysis on the 10% confirmatory samples.

Figure 11: GPR Survey Results
ABC Plating Site

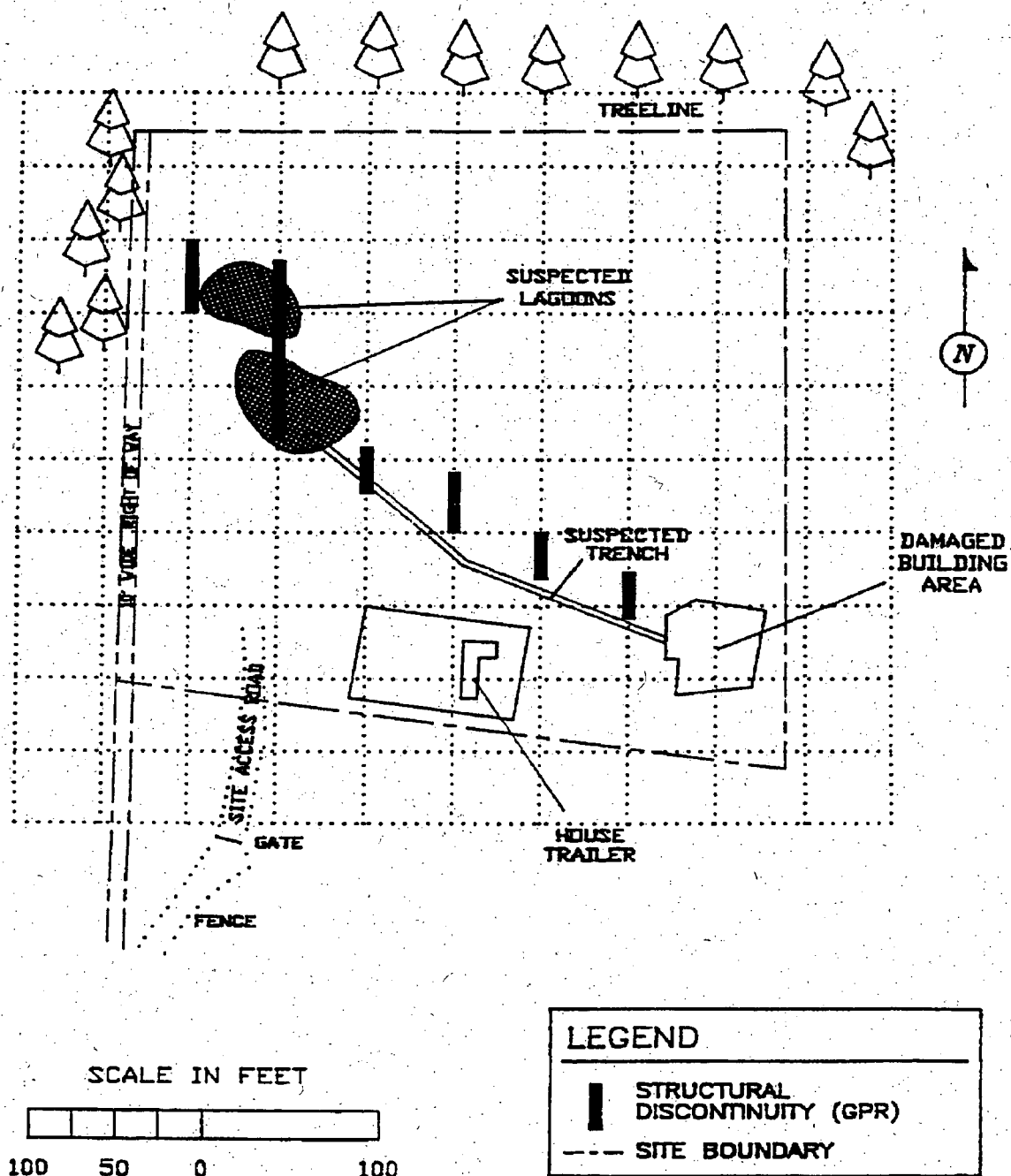
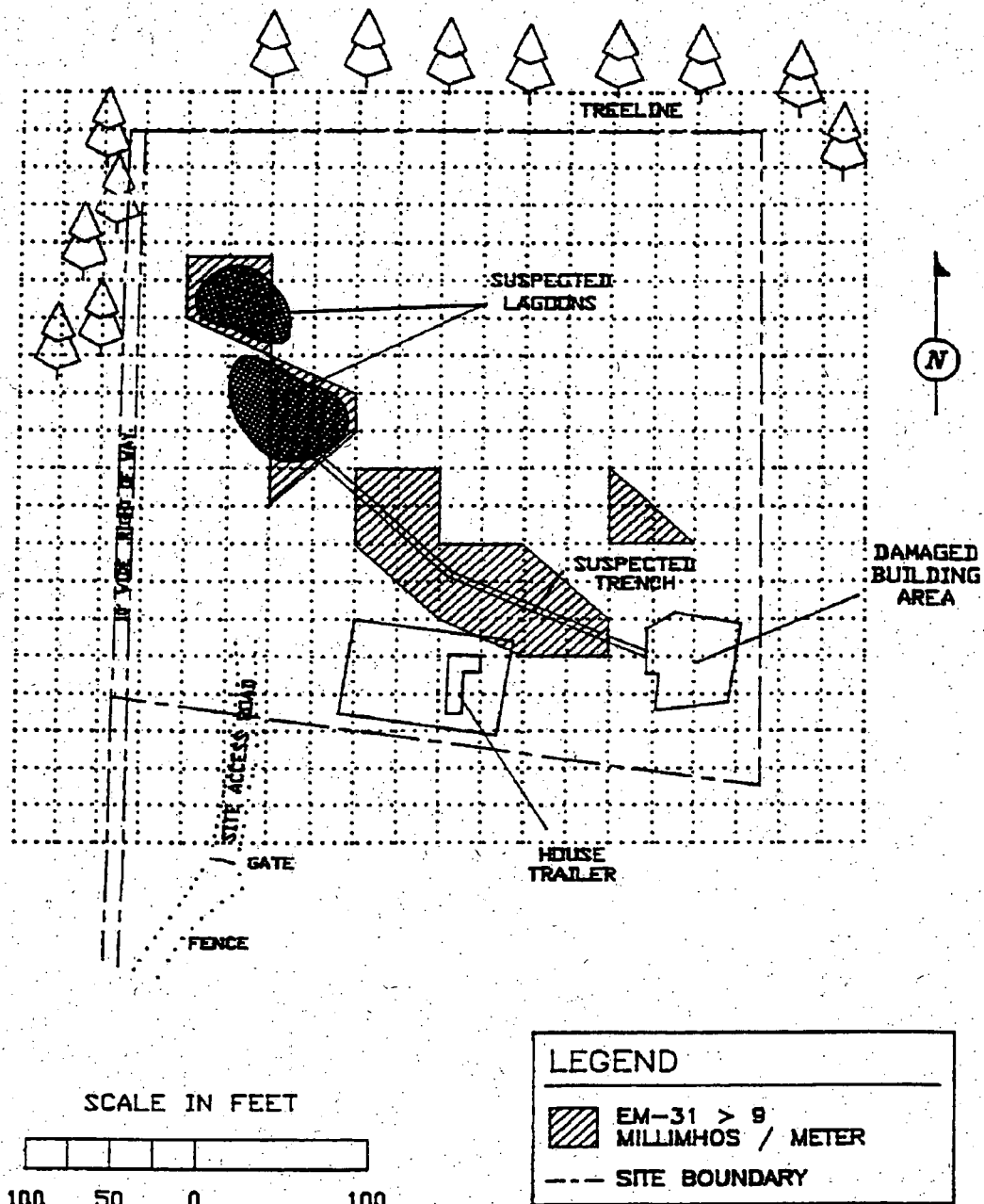


Figure 12: EM-31 Survey Results
ABC Plating Site



3.0 EQUIPMENT

3.1 INTRODUCTION

Sample collection requires an understanding of the capabilities of the sampling equipment, since using inappropriate equipment may result in biased samples. This chapter provides information for selecting sampling and screening equipment.

3.2 ANALYTICAL SCREENING EQUIPMENT

Analytical screening methods provide on-site measurements of contaminants of concern, limiting the number of samples which need to be sent to an off-site laboratory for time-consuming and often costly analysis. Screening techniques can also evaluate soil samples for indications that soil contamination exists (e.g., X-ray fluorescence (XRF) for target metals or soil gas survey for identification of buried wastes or other subsurface contamination). All screening equipment and methods described in this section are **portable** (the equipment is hand-held, and generally no external power is necessary). Examples are photoionization detectors (PID), flame ionization detectors (FID), and some XRF devices.

Screening generally provides analytical data of suitable quality for site characterization, monitoring during response activities, and on-site health and safety decisions. The methods presented here can provide rapid, cost-effective, real-time data; however, results are often not compound-specific and not quantitative.

When selecting one screening method over another, consider relative cost, sample analysis time, potential interferences or instrument limitations, detection limit, QA/QC requirements, level of training required for operation, equipment availability, and data bias. Also consider which elements, compounds, or classes of compounds the screening instrument is designed to analyze. As discussed in Section 2.7, the screening method selected should be sensitive enough to minimize the potential for false negatives. When collecting samples for on-site analysis (e.g., XRF), evaluate the detection limits and bias of the screening method by sending a minimum of 10% of the samples to an off-site laboratory for confirmation. Table 3 summarizes the advantages and disadvantages of selected portable screening equipment.

3.3 GEOPHYSICAL EQUIPMENT

Geophysical techniques can be used in conjunction with analytical screening to help delineate areas of subsurface contamination, including buried drums and tanks. Geophysical data can be obtained relatively rapidly, often without disturbing the site. Geophysical techniques suitable for emergency or removal activities include: ground penetrating radar (GPR), magnetometry, electromagnetic conductivity (EM) and resistivity. Specific advantages and disadvantages associated with geophysical equipment are summarized in Table 4. See also EPA ERT Standard Operating Procedure (SOP) #2159, General Surface Geophysics (U.S. EPA, January 1991).

3.4 SELECTING SAMPLING EQUIPMENT

The mechanical method by which a sampling tool collects the sample may impact representativeness. For example, if the sampling objective is to determine the concentrations of contaminants at each soil horizon interface, using a hand auger would be inappropriate: the augering technique would disrupt and mix soil horizons, making the precise horizon interface difficult to determine. Depth of sampling is another factor to consider in the proper selection of sampling equipment. A trowel, for example, is suitable for unconsolidated surface soils, but may be a poor choice for sampling at 12 inches, due to changes in soil consistency with depth.

All sampling devices should be of sufficient quality not to contribute contamination to samples (e.g., painted surfaces which could chip off into the sample). In addition, the sampling equipment should be either easily decontaminated, or cost-effective if considered to be expendable. Consider ease of use when selecting sampling equipment.

Table 3: Portable Field Analytical Screening Equipment

<u>Equipment</u>	<u>Application to Sampling Design</u>	<u>Advantages and Disadvantages</u>
X-ray fluorescence (portable)	Detects heavy metals in soils	Rapid sample analysis; may be used in situ; requires trained operator; potential matrix interferences; may be used with a generic or site-specific calibration model; detection limit may exceed action level; detects to ppm level; detection limit should be calculated on a site-specific basis.
Flame ionization detector (FID)	Semi-quantitatively detects VOCs in soils	Immediate results; can be used in GC mode to identify specific organic compounds; detects VOCs only; detects to ppm level.
Photoionization detector (PID)	Detects total concentration of VOCs and some non-volatile organics and inorganics in soils	Immediate results; easy to use; non-compound specific; results affected by high ambient humidity and electrical sources such as radios; does not respond to methane; detects to ppm level.
Field test kits	Detects specific elements, compounds, or compound classes in soils	Rapid results; easy to use; low cost; limited number of kit types available; kits may be customized to user needs; semi-quantitative; interferences by other analytes is common; colorimetric interpretation is needed; detection level dependent upon type of kit used; can be prone to error.
Radiation detector	Detects the presence of selected forms of radiation in soils or other waste materials	Easy to use; low cost; probes for one or a combination of alpha, beta or gamma forms of radiation; unit and detection limits vary greatly; detailed site surveys are time intensive and require experienced personnel to interpret results.

Sources: U.S. EPA, September 1988a; U.S. EPA, December 1987; U.S. EPA 1987.

Table 4: Geophysical Equipment

<u>Equipment</u>	<u>Application to Sampling Design</u>	<u>Advantages and Disadvantages</u>
Ground penetrating radar (GPR)	Detects reflection anomalies caused by lithology changes buried objects; varying depths of investigation, 15 to 30 feet, are possible.	Capable of high resolution; generates continuous measurement profile; can survey large area quickly; site specific; best results are achieved in dry, sandy soils; clay-rich and water saturated soils produce poor reflections and limit depth of penetration; data interpretation requires a trained geophysicist.
Magnetometer	Detects presence and areal extent of ferromagnetic material in subsurface soils, including buried metal containers. Single 55-gallon drums can be identified at depths up to 10 feet and large massed of drums up to 30 feet or more.	Quick and easy to operate; good initial survey instrument; readings are often affected by nearby man-made steel structures (including above-ground fences, buildings, and vehicles); data interpretation may require geophysicist.
Electromagnetic conductivity meter (EM)	Detects electrical conductivity changes in subsurface geologic lithology, pore fluids, and buried objects. Depth of investigation varies from 9 feet to 180 feet depending on instrument used, coil spacing, and coil configuration.	Rapid data collection; can delineate inorganic and large-scale organic contamination in subsurface fluids; sensitive to man-made structures (including buried cables, above-ground steel structures and electrical power lines); survey planning and data interpretation may require geophysicist.
Wadi	Detects electrical conductivity changes in surface and sub-surface materials utilizing existing very low frequency (VLF) radio waves.	Utilizes existing long-distance communication VLF radio waves (10-30 Khz range); no need to induce electrical field; directional problems can be overcome with portable transmitters.
Resistivity meter	Detects electrical resistivity variations in subsurface materials (e.g., lithology, pore fluids, buried pipelines and drums). Vertical resolution to depths of 100 feet are possible.	Detects lateral and vertical variations; instrument requires direct ground contact, making it relatively labor intensive; sensitive to outside interference; data interpretation requires a trained geophysicist.

Sources: Benson, et. al. 1988; NJDEP, 1988.

Complicated sampling procedures usually require increased training and introduce a greater likelihood of procedural errors. Standard operating procedures help to avoid such errors. Sample volume is another selection concern. Specific advantages and disadvantages of soil sampling equipment are given in Table 5. Refer also to EPA ERT SOP #2012, Soil Sampling (in U.S. EPA, January 1991) for guidance on using various types of soil sampling equipment.

3.5 EXAMPLE SITE

3.5.1 Selection of Sampling Equipment



Dedicated plastic scoops were used for Phase 1 soil sampling. For Phase 2, the OSC used bucket augers for both surface and subsurface soil sampling because of their ease of use, good vertical depth range, and uniform surface sampling volume. Standard operating procedures were followed to promote proper sample collection, handling, and decontamination. From the bucket auger, each sample was placed into a dedicated plastic pan and mixed using a dedicated plastic scoop. Samples were further prepared for XRF screening and laboratory analysis (Section 4.8).

3.5.2 Selection of Analytical Screening Equipment

Phase 1 sampling identified the sources and types of on-site contaminants in order to establish a threat. Hazard categorization techniques, organic vapor detecting instruments, and radiation and cyanide monitors were utilized to tentatively identify containerized liquid wastestreams in order to select initial judgmental soil sampling locations. During Phase 2 sampling, a portable XRF unit was used to determine the extent of contamination and to identify additional hot spots. Samples to be sent for laboratory analysis were then placed into sampling jars (as discussed in Section 4.8). Samples collected from upgradient grid nodes for XRF screening only were stored on site for later treatment/disposal. For Phase 3, the XRF was used to confirm whether contaminated areas identified during Phase 2 were sufficiently excavated.

3.5.3 Selection of Geophysical Equipment

The GPR instrument delineated buried trench and lagoon boundaries. The EM meter detected subsurface conductivity changes due to buried metal containers and contaminants. The EM-31 (a shallower-surveying instrument than the EM-34) was selected because expected contaminant depth was less than 10 feet and because of the instrument's maneuverability and ease of use.

Table 5: Soil Sampling Equipment

<u>Equipment</u>	<u>Applicability</u>	<u>Advantages and Disadvantages</u>
Trier	Soft surface soil	Inexpensive; easy to use and decontaminate; difficult to use in stony, dry, or sandy soil.
Scoop or trowel	Soft surface soil	Inexpensive, easy to use and decontaminate; trowels with painted surfaces should be avoided.
Tulip bulb planter	Soft soil, 0-6 in.	Easy to use and decontaminate; uniform diameter and sample volume; preserves soil core (suitable for VOA and undisturbed sample collection); limited depth capability; not useful for hard soils.
Soil coring device	Soft soil, 0-24 in.	Relatively easy to use; preserves soil core (suitable for VOA and undisturbed sample collection); limited depth capability; can be difficult to decontaminate.
Thin-wall tube sampler	Soft soil, 0-10 ft.	Easy to use; preserves soil core (suitable for VOA and undisturbed sample collection); may be used in conjunction with bucket auger; acetate sleeve may be used to help maintain integrity of VOA samples, easy to decontaminate; can be difficult to remove cores from sampler.
Split spoon sampler	Soil, 0 in.-bedrock	Excellent depth range; preserves soil core (suitable for VOA and undisturbed sample collection); acetate sleeve may be used to help maintain integrity of VOA samples; useful for hard soils; often used in conjunction with drill rig for obtaining deep cores.
Shelby tube sampler	Soft soil, 0 in.-bedrock	Excellent depth range; preserves soil core (suitable for VOA and undisturbed sample collection); tube may be used to ship sample to lab undisturbed; may be used in conjunction with drill rig for obtaining deep cores and for permeability testing; not durable in rocky soils.
Bucket auger	Soft soil, 3 in.-10 ft.	Easy to use; good depth range; uniform diameter and sample volume; acetate sleeve may be used to help maintain integrity of VOA samples; may disrupt and mix soil horizons greater than 6 inches in thickness.
Hand-operated power auger	Soil, 6 in.-15 ft.	Good depth range; generally used in conjunction with bucket auger for sample collection; destroys soil core (unsuitable for VOA and undisturbed sample collection); requires 2 or more equipment operators; can be difficult to decontaminate; requires gasoline-powered engine (potential for cross-contamination).

Sources: NJDEP, 1988; U.S. EPA, January 1991.

4.0 SAMPLE COLLECTION AND PREPARATION

4.1 INTRODUCTION

In addition to sampling equipment, sample collection includes sample quantity and sample volume. Sample preparation refers to all aspects of sample handling after collection, until the sample is received by the laboratory. Sample preparation for soils may include, but is not limited to:

- removing extraneous material;
- sieving samples;
- homogenizing samples;
- splitting samples;
- compositing samples; and
- final preparation.

Sample preparation depends on the sampling objectives and analyses to be performed. Proper sample preparation and handling help to maintain sample integrity. Improper handling can result in a sample becoming unsuitable for the type of analysis required. For example, homogenizing, sieving, and compositing samples all result in a loss of volatile constituents and are therefore inappropriate when volatile contaminants are the concern.

4.2 SAMPLE COLLECTION

How a sample is collected can affect its representativeness. The greater the number of samples collected from a site and the larger the volume of each sample, the more representative the analytical results will be. However, sampling activities are often limited by sampling budgets and project schedules. The following sections provide guidelines on appropriate sample numbers and volumes.

4.2.1 Sample Number

The number of samples needed will vary according to the particular sampling approach that is being used. For example, in grid sampling, one sample is generally collected at each grid node, regardless of grid size. As discussed in Section 2.11.6, once contaminated grid node samples are located, adjoining grid cells can be sampled more thoroughly to define areas of contamination. Four aliquots from each grid cell, situated equidistant from the sides of each cell and each other (as illustrated in Figure 10), are recommended for grid cells measuring up to 100 x 100 feet. One additional aliquot may be collected from the

center of each cell, making a total of five aliquots per cell. For grid sizes greater than 100 feet x 100 feet, nine aliquots, situated equidistant from the sides of each cell and each other (as illustrated in Figure 13), are recommended. Depending on budget and other considerations, grid cell aliquots can be analyzed as separate samples or composited into one or more samples per cell.

4.2.2 Sample Volume

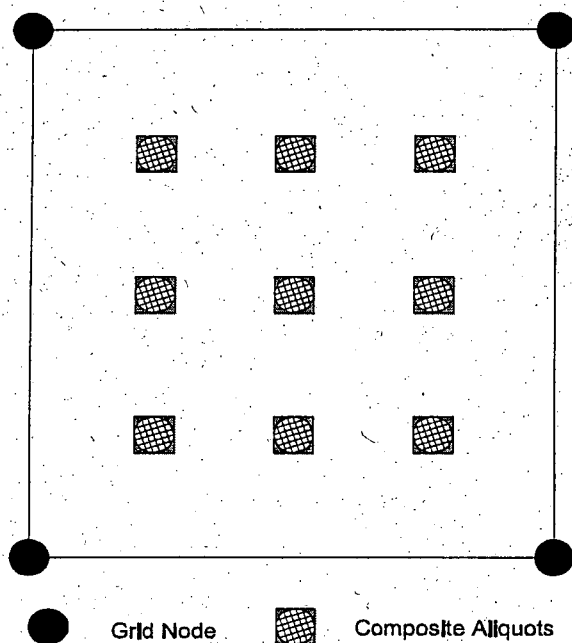
Both sample depth and area are considerations in determining appropriate sample volume. Depending on the analytes being investigated, samples are collected at the surface (0-3 in.), extended surface (0-6 in.), and/or at one-foot depth intervals. Non-water soluble contaminants such as dioxin and PCBs are often encountered within the first six inches of soil. Water-soluble contaminants such as metals, acids, ketones, and alcohols will be encountered at deeper depths in most soils except clays. Contaminants in solution, such as PCBs in diesel fuel and pesticides in solvents, can penetrate to great depths (e.g., down to bedrock), depending on soil type.

For surface samples, collect soil over a surface area of one square foot per sample. A square cardboard template measuring 12 in. x 12 in., or a round template with a 12 in. diameter can be used to mark sampling areas. For subsurface samples, one of several coring devices may be used (see Table 5). Using a coring device results in a smaller diameter sampling area than a surface template, and therefore somewhat lessens the representativeness of the sample.

4.3 REMOVING EXTRANEOUS MATERIAL

Identify and discard materials in a sample which are not relevant or vital for characterizing the sample or the site, since their presence may introduce an error in the sampling or analytical procedures. Examples of extraneous material in soil samples include pieces of glass, twigs or leaves. However, not all non-soil material is extraneous. For example, when sampling at a junkyard, lead-contaminated battery casing pieces should not be removed from a sample if the casing composes more than 10% of the sample composition. For a sample to be representative, it must also incorporate the lead from the casing. Collect samples

Figure 13: Phase 2 Sampling Grid Cell Diagram (Grid Sizes > 100 x 100 ft.)



of any material thought to be a potential source of contamination for a laboratory extraction procedure. Discuss any special analytical requirements for extraneous materials with project management, geologists, and chemists and notify the laboratory of any special sample handling requirements.

4.4 SIEVING SAMPLES

Sieving is the process of physically sorting a sample to obtain uniform particle sizes, using sieve screens of predetermined size. For example, the sampler may wish to sieve a certain number of samples to determine if particle size is related to contaminant distribution. Sieving is generally only conducted when preparing soil samples for XRF screening. For this purpose, a 20-mesh screen size is recommended.

Be aware of the intent of the sampling episode, when deciding whether to sieve a sample prior to analysis. Prior to sieving, samples may need to be oven-dried. Discarding non-soil or non-sieved materials, as well as the sieving process itself, can result in physical and chemical losses. Sieving is not recommended where volatile compounds are of concern. Analyze the discarded materials, or a fraction thereof, to determine their contribution to the contamination of the site being investigated.

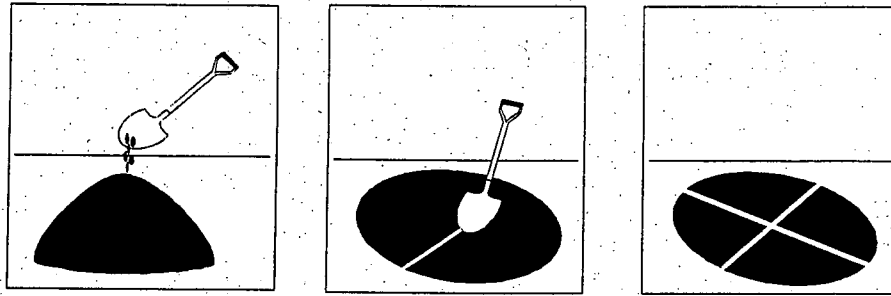
4.5 HOMOGENIZING SAMPLES

Homogenization is the mixing or blending of a soil sample in an attempt to provide uniform distribution of contaminants. (Do not homogenize samples for volatile compound analysis). Ideally, proper homogenization ensures that portions of the containerized samples are equal or identical in composition and are representative of the total soil sample collected. Incomplete homogenization will increase sampling error. All samples to be composited or split should be homogenized after all aliquots have been combined. Manually homogenize samples using a stainless steel spoon or scoop and a stainless steel bucket, or use a disposable scoop and pan. Quarter and split the sample as illustrated in Figure 14, repeating each step a minimum of 5 times until the sample is visually homogenized. Samples can also be homogenized using a mechanically-operated stirring device as depicted in ASTM standard D422-63.

4.6 SPLITTING SAMPLES

Splitting samples after collection and field preparation into two or more equivalent parts is performed when two or more portions of the same sample need to be analyzed separately. Split samples are most often collected in enforcement actions to compare sample results obtained by EPA with those obtained by the potentially responsible party (PRP). Split samples also provide a measure of the sample variability, and a measure of the analytical and extraction errors. Before splitting, follow homogenization techniques outlined above. Fill two sample collection jars simultaneously with alternate spoonfuls (or scoopfuls) of homogenized sample. To simultaneously homogenize and split a sample, **quarter** (as illustrated in Figure 14) or **mechanically** split the sample using a riffle sample splitter. The latter two techniques are described in detail in ASTM Standard C702-87.

Figure 14: Quartering to Homogenize and Split Samples



Step 1:

- Cone sample on hard, clean surface
- Mix by forming new cone

Step 2:

- Flatten cone
- Divide sample into quarters

Step 3: (not shown)

- Remix opposite quarters
- Reform cone
- Repeat a minimum of 5 times

4.7 COMPOSITING SAMPLES

Compositing is the process of physically combining and homogenizing several individual soil aliquots. Compositing samples provides an average concentration of contaminants over a certain number of sampling points, which reduces both the number of required lab analyses and the sample variability. Compositing can be a useful technique, but must always be implemented with caution. Compositing is not recommended where volatile compounds are of concern.

Specify the method of selecting the aliquots that are composited and the compositing factor in the sampling plan. The compositing factor is the number of aliquots to be composited into one sample (e.g., 3 to 1; 10 to 1). Determine this factor by evaluating detection limits for parameters of interest and comparing them with the selected action level for that parameter. Compositing also requires that each discrete aliquot be the same in terms of volume or

weight, and that the aliquots be thoroughly homogenized. Since compositing dilutes high concentration aliquots, the applicable detection limits should be reduced accordingly. If the composite value is to be compared to a selected action level, then the action level must be divided by the number of aliquots that make up the composite in order to determine the appropriate detection limit (e.g., if the action level for a particular substance is 50 ppb, an action level of 10 ppb should be used when analyzing a 5-aliquot composite). The detection level need not be reduced if the composite area is assumed to be homogeneous in concentration (for example, stack emission plume deposits of particulate contamination across an area, or roadside spraying of waste oils).

4.8 FINAL PREPARATION

Select sample containers on the basis of compatibility with the material being sampled, resistance to breakage, and volume. For soil sampling, use wide-mouth glass containers with Teflon-lined lids. Appropriate sample volumes and containers will vary according to the parameter being analyzed. Keep low and medium concentration soil samples to be analyzed for organic constituents at 4°C. Actual sample volumes, appropriate containers, and holding times are specified in the *QA/QC Guidance for Removal Activities* (U.S. EPA, April 1990), in 40 CFR 136, and in the Compendium of ERT Soil Sampling and Surface Geophysics (U.S. EPA, January 1991). Package all samples in compliance with Department of Transportation (DOT) or International Air Transport Association (IATA) requirements.

It is sometimes possible to ship samples to the laboratory directly in the sampling equipment. For example, the ends of a Shelby tube can be sealed with caps, taped, and sent to the laboratory for analysis. To help maintain the integrity of VOA samples, collect soil cores using acetate sleeves and send the sleeves to the laboratory. To ensure the integrity of the sample after delivery to the laboratory, make laboratory sample preparation procedures part of all laboratory bid contracts.

4.9 EXAMPLE SITE

After placing each sample in a dedicated pan and mixing (as discussed in Section 3.5.1), plant matter, stones, and broken glass were removed. Soil samples were oven-dried (at 104° C) and sieved using a 20-mesh screen in preparation for XRF analysis.

Samples were then homogenized and split using the quartering technique. Opposite quarters were remixed and quartering was repeated five times to ensure thorough homogenization. A portion of each sample was placed into XRF analysis cups for screening. The remainder of each sample was placed into 8-ounce, wide-mouth glass jars with Teflon-lined lids and sent to a laboratory for inorganic analysis. The samples were packaged in compliance with IATA requirements. Chain-of-custody paperwork was prepared for the samples. Laboratory paperwork was completed as appropriate and the samples were shipped to the predesignated laboratories for analysis.



5.0 QUALITY ASSURANCE/QUALITY CONTROL EVALUATION

5.1 INTRODUCTION

The goal of representative sampling is to collect samples which yield analytical results that accurately depict site conditions during a given time frame. The goal of quality assurance/quality control (QA/QC) is to identify and implement correct methodologies which limit the introduction of error into the sampling and analytical procedures, ultimately affecting the analytical data.

QA/QC samples evaluate the degree of site variation, whether samples were cross-contaminated during sampling and sample handling procedures, or if a discrepancy in sample results is due to laboratory handling and analysis procedures. The QA/QC sample results are used to assess the quality of the analytical results of waste and environmental samples collected from a site.

5.2 DATA CATEGORIES

EPA has established a process of data quality objectives (DQOs) which ensure that the precision, accuracy, representativeness, and quality of environmental data are appropriate for their intended application. Superfund DQO guidance defines two broad categories of analytical data: *screening* and *definitive*.

Screening data are generated by rapid, less precise methods of analysis with less rigorous sample preparation. Sample preparation steps may be restricted to simple procedures such as dilution with a solvent, rather than elaborate extraction/digestion and cleanup. At least 10 percent of the screening data are confirmed using the analytical methods and QA/QC procedures and criteria associated with definitive data. Screening data without associated confirmation data are not considered to be data of known quality. To be acceptable, screening data must include the following: chain of custody, initial and continuing calibration, analyte identification, and analyte quantification. Streamlined QC requirements are the defining characteristic of screening data.

Definitive data are generated using rigorous analytical methods (e.g., approved EPA reference methods). These data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or

computer-generated electronic files. Data may be generated at the site or at an off-site location, as long as the QA/QC requirements are satisfied. For the data to be definitive, either analytical or total measurement error must be determined. QC measures for definitive data contain all of the elements associated with screening data, but also may include trip, method, and rinsate blanks; matrix spikes; performance evaluation samples; and replicate analyses for error determination.

For further information on these QA/QC objectives, please refer to EPA's *Quality Assurance/Quality Control Guidance for Removal Activities* or EPA's *Data Quality Objectives Process for Superfund*.

5.3 SOURCES OF ERROR

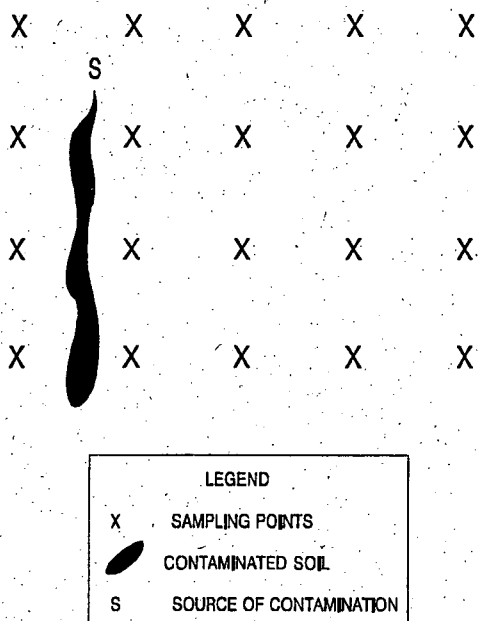
Identifying and quantifying the error or variation in sampling and laboratory analysis can be difficult. However, it is important to limit their effect(s) on the data. Four potential sources of error are:

- sampling design;
- sampling methodology;
- sample heterogeneity; and
- analytical procedures.

5.3.1 Sampling Design

Site variation includes the variation both in the types and in the concentration levels of contaminants throughout a site. Representative sampling should accurately identify and define this variation. However, error can be introduced by the selection of a sampling design which "misses" site variation. For example, a sampling grid with relatively large distances between sampling points or a biased sampling approach (i.e., judgmental sampling) may allow significant contaminant trends to go unidentified, as illustrated in Figure 15.

Figure 15: Sampling Error Due to Sampling Design



5.3.2 Sampling Methodology

Error can be introduced by the sampling methodology and sample handling procedures, as in cross-contamination from inappropriate use of sample collection equipment, unclean sample containers, improper sampling equipment decontamination and shipment procedures, and other factors. Standardized procedures for collecting, handling, and shipping samples allow for easier identification of the source(s) of error, and can limit error associated with sampling methodology. The use of standard operating procedures ensures that all sampling tasks for a given matrix and analyte will be performed in the same manner, regardless of the individual sampling team, date, or location of sampling activity. Trip blanks, field blanks, replicate samples, and rinsate blanks are used to identify error due to sampling methodology and sample handling procedures.

5.3.3 Sample Heterogeneity

Sample heterogeneity is a potential source of error. Unlike water, soil is rarely a homogeneous medium, and it exhibits variable properties with lateral distance and with depth. This heterogeneity may also be present in the sample container unless the sample was homogenized in the field or in the laboratory. The laboratory uses only a small aliquot of the sample for analysis; if the sample is not properly homogenized, the analysis may not be truly representative of the sample and of the corresponding site. Thoroughly homogenizing samples, therefore, can limit error associated with sample heterogeneity.

5.3.4 Analytical Procedures

Error which may originate in analytical procedures includes cross-contamination, inefficient extraction, and inappropriate methodology. Matrix spike samples, replicate samples, performance evaluation samples, and associated quality assurance evaluation of recovery, precision, and bias, can be used to distinguish analytical error from error introduced during sampling activities.

5.4 QA/QC SAMPLES

This section briefly describes the types and uses of QA/QC samples that are collected in the field, or prepared for or by the laboratory. QA/QC samples are analyzed in addition to field samples and provide information on the variability and usability of environmental sample results. They assist in identifying the origin of analytical discrepancies to help determine how the analytical results should be used. They are used mostly to validate analytical results. Field replicate, collocated, background, and rinsate blank samples are the most commonly collected field QA/QC samples. Performance evaluation, matrix spike, and matrix spike duplicate samples, either prepared for or by the laboratory, provide additional measures of control for the data generated. QA/QC results may suggest the need for modifying sample collection, preparation, handling, or analytical procedures if the resultant data do not meet site-specific quality assurance objectives. Refer to data validation procedures in U.S. EPA, April 1990, for guidelines on utilizing QA/QC analytical results. The following paragraphs briefly describe each type of QA/QC sample.

5.4.1 Field Replicates

Field replicates are field samples obtained from one location, homogenized, divided into separate containers and treated as separate samples throughout the remaining sample handling and analytical processes. These samples are used to assess error associated with sample heterogeneity, sample methodology and analytical procedures. Use field replicates when determining total error for critical samples with contamination concentrations near the action level. For statistical analysis to be valid in such a case, a minimum of eight replicate samples would be required.

5.4.2 Collocated Samples

Collocated samples are collected adjacent to the routine field sample to determine local variability of the soil and contamination at the site. Typically, collocated samples are collected about one-half to three feet away from the selected sample location. Analytical results from collocated samples can be used to assess site variation, but only in the immediate sampling area. Due to the non-homogeneous nature of soil at sites, collocated samples should not be used to assess variability across a site and are not recommended for assessing error. Determine the applicability of collocated samples on a site-by-site basis. Collecting many samples (more than 50 samples/acre), is sufficient to demonstrate site variation.

5.4.3 Background Samples

Background samples are collected upgradient of the area(s) of contamination (either on or off site) where there is little or no chance of migration of the contaminants of concern. Background samples determine the natural composition of the soil (especially important in areas with high concentrations of naturally-occurring metals) and are considered "clean" samples. They provide a basis for comparison of contaminant concentration levels with samples collected on site. At least one background soil sample should be collected; however, more are warranted when site-specific factors such as natural variability of local soil, multiple on-site contaminant source areas, and presence of off-site facilities potentially contributing to soil contamination exist. Background samples may be collected for all QA objectives, in order to evaluate potential error associated with sampling design, sampling methodology, and analytical procedures.

5.4.4 Rinsate Blanks

Rinsate blanks are samples obtained by running analyte-free water over decontaminated sampling equipment to test for residual contamination. The blank is placed in sample containers for handling, shipment, and analysis identical to the samples collected that day. A rinsate blank is used to assess cross-contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank, per type of sampling device, per day.

5.4.5 Performance Evaluation Samples

Performance evaluation (PE) samples evaluate the overall bias of the analytical laboratory and detect any error in the analytical method used. These samples are usually prepared by a third party, using a quantity of analyte(s) which is known to the preparer but unknown to the laboratory, and always undergo certification analysis. The analyte(s) used to prepare the PE sample is the same as the analyte(s) of concern. Laboratory procedural error is evaluated by the percentage of analyte identified in the PE sample (percent recovery). Even though they are not available for every single analyte, analysis of PE samples is required to obtain definitive data.

5.4.6 Matrix Spike Samples

Matrix spike and matrix spike duplicate samples (MS/MSDs) are environmental samples that are spiked in the laboratory with a known concentration of a target analyte(s) to verify percent recoveries. MS/MSDs are primarily used to check sample matrix interferences. They can also be used to monitor laboratory performance. However, a dataset of at least three or more results is necessary to distinguish between laboratory performance and matrix interference.

MS/MSDs can also monitor method performance. Again, a dataset is helpful to assess whether a method is performing properly. Generally, interference and poor method performance go together.

MS/MSDs can also evaluate error due to laboratory bias and precision (when four or more pairs are analyzed). Analyze one MS/MSD pair to assess bias for every 20 soil samples. Use the average percent recovery for the pair. To assess precision, analyze at least 8 matrix spike replicates from the same sample, determine the standard deviation and the coefficient of variation. See pages 9 - 10 of the *QA/QC Guidance*

for Removal Activities (U.S. EPA, April 1990) for procedures on calculating analytical error. MS/MSDs are optional when the goal is to obtain screening data and required to obtain definitive data as one of several methods to determine analytical error.

5.4.7 Field Blanks

Field blanks are samples prepared in the field using certified clean sand or soil and are then submitted to the laboratory for analysis. A field blank is used to evaluate contamination error associated with sampling methodology and laboratory procedures. If available, submit field blanks at a rate of one per day.

5.4.8 Trip Blanks

Trip blanks are samples prepared prior to going into the field. Trip blanks consist of certified clean sand or soil and are handled, transported, and analyzed in the same manner as the other volatile organic samples acquired that day. Trip blanks are used to evaluate error associated with sampling methodology and analytical procedures by determining if any contamination was introduced into samples during sampling, sample handling and shipment, and/or during laboratory handling and analysis. If available, utilize trip blanks for volatile organic analyses.

5.5 EVALUATION OF ANALYTICAL ERROR

The percentage and types of QA/QC samples needed to help identify the error and confidence in the data is based on the sampling objectives and the corresponding QA/QC objectives. The acceptable level of error is determined by the intended use of the data and the sampling objectives, including such factors as: the degree of threat to public health, welfare, or the environment; selected action levels; litigation concerns; and budgetary constraints.

The use of replicate samples is one method to evaluate error. To evaluate the total error of samples with contaminant concentrations near the selected action level, prepare and analyze a minimum of eight replicates of the same sample. Analytical data from replicate samples can also be used for a quick check on errors associated with sample heterogeneity, sample methodology and analytical procedures. Differing analytical results from two or more replicate samples could indicate improper sample preparation (e.g., incomplete homogenization), or that contamination was introduced during sample collection, preparation, handling, shipment, or

analysis.

It may be desirable to try to quantify confidence; however, quantification or analytical data correction is not always possible. A 95% confidence level (i.e., 5% acceptable error) should be adequate for most sampling activities. Experience will provide the best determination of whether to use a higher (e.g., 99%) or lower (e.g., 90%) level of confidence. It must be recognized that the use of confidence levels is based on the assumption that a sample is homogeneous. See also Section 6.8 for information on total error.

5.6 CORRELATION BETWEEN SCREENING RESULTS AND DEFINITIVE RESULTS

One cost-effective approach for delineating the extent of site contamination is to correlate inexpensive screening data and other field measurements (e.g., XRF, soil-gas measurements) with laboratory results. The relationship between the two methods can then be described by a regression analysis and used to predict laboratory results based on screening measurements. In this manner, cost-effective screening results may be used in addition to, or in lieu of, off-site laboratory sample analysis.

Statistical regression involves developing a model (equation) that relates two or more variables at an acceptable level of correlation. When screening techniques, such as XRF, are used along with laboratory methods (e.g., atomic absorption (AA)), a regression equation can be used to predict a laboratory value based on the results of the screening device. The model can also be used to place confidence limits around predictions. Additional discussion of correlation and regression can be found in most introductory statistics textbooks. A simple regression equation (e.g., linear) can be developed on many calculators or computer databases; however, a statistician should be consulted to check the accuracy of more complex models.

Evaluation of the accuracy of a model in part relies on statistical correlation. Statistical correlation involves computing an index called the correlation coefficient (r) that indicates the degree and nature of the relationship between two or more sets of values. The correlation coefficient ranges from -1.0 (a perfect inverse or negative relationship), through 0 (no relationship), to +1.0 (a perfect direct, or positive, relationship). The square of the correlation coefficient, called the coefficient of determination, or simply R^2 , is an estimate of the proportion of variance

in one variable (the dependent variable) that can be accounted for by the independent variables. The R^2 value that is acceptable depends on the sampling objectives and intended data uses. As a rule of thumb, statistical relationships should have an R^2 value of at least 0.6 to determine a reliable model; however, for health or risk assessment purposes, the acceptable R^2 value may be made more stringent (e.g., 0.8). Analytical calibration regressions have an R^2 value of 0.98 or better.

Once a reliable regression equation has been derived, the screening data can be used to predict laboratory results. These predicted values can then be located on a base map and contoured (mapping methods are described in Chapter 6). These maps can be examined to evaluate the estimated extent of contamination and the adequacy of the sampling program.

5.7 EXAMPLE SITE

The screening of containerized liquid wastes was performed to quickly obtain data indicating general chemical class. Definitive analysis was run on



10% of the samples in order to verify screening results. The definitive analyses provided were analyte and concentration specific. Recoveries of matrix spike and matrix spike duplicate samples indicated no matrix interferences. Dedicated equipment was used during Phase 1 sampling, making rinsate blanks unnecessary. Phase 2 screening was performed using XRF. During Phase 2, samples were collected at 30% of the nodes screened with the XRF. These samples were sent for laboratory AA analysis. A correlation was established by plotting the Phase 2 AA and XRF data. This allowed the XRF data from the other 70% of the nodes to be used to evaluate the chromium levels across the site.

For Phase 2 and 3 sampling, 10% of the data were confirmed by running replicate analyses to obtain an estimate of precision. The results indicated good correlation. Matrix spikes and matrix spike duplicate samples indicated no matrix interferences. During Phase 2, the OSC included performance evaluation (PE) samples for metals to evaluate the overall laboratory bias. The laboratory achieved 92% recovery, which was within the acceptable control limits.

During Phases 2 and 3, a rinsate blank was collected each day. Following the decontamination of the bucket augers, analyte-free water was poured over the augers and the rinsate was placed into 1-liter polyethylene bottles and preserved. The rinsate blanks were analyzed for total metals and cyanide to determine the effectiveness of the decontamination procedures and the potential for cross-contamination. All rinsate blank samples were "clean", indicating sufficient decontamination procedures.

The correlation analysis run on Phase 2 laboratory (AA) data and corresponding XRF values resulted in r values of 0.97 for both surface and subsurface data, which indicated a strong relationship between the AA and XRF data. Following the correlation analyses, regression analyses were run and equations to predict laboratory values based on the XRF data were developed. The resulting equation for the surface data was: $AA = 0.87 (XRF) + 10.16$. The resulting regression equation for the subsurface data was: $AA = 0.94 (XRF) + 0.30$.

6.0 DATA PRESENTATION AND ANALYSIS

6.1 INTRODUCTION

Data presentation and analysis techniques are performed with analytical, geophysical, or screening results. The techniques discussed below can be used to compare analytical values, to evaluate numerical distribution of data, to determine and illustrate the location of hot spots and the extent of contamination across a site, and to assess the need for removal of contaminated soil with concentrations at or near the action level. The appropriate methods to present and analyze sample data depend on the sampling objectives, the number of samples collected, the sampling approaches used, and a variety of other considerations.

6.2 DATA POSTING

Data posting involves placement of sample values on a site basemap. Data posting is useful for displaying the spatial distribution of sample values to visually depict extent of contamination and to locate hot spots. Data posting requires each sample to have a specific location (e.g., X and Y coordinates). Ideally, the sample coordinates would be surveyed values to facilitate placement on a scaled map.

6.3 GEOLOGIC GRAPHICS

Geologic graphics include cross-sections and fence diagrams, which are two- and three-dimensional depictions, respectively, of soils and strata to a given depth beneath the site. These types of graphics are useful for posting subsurface analytical data as well as for interpreting subsurface geology and contaminant migration.

6.4 CONTOUR MAPPING

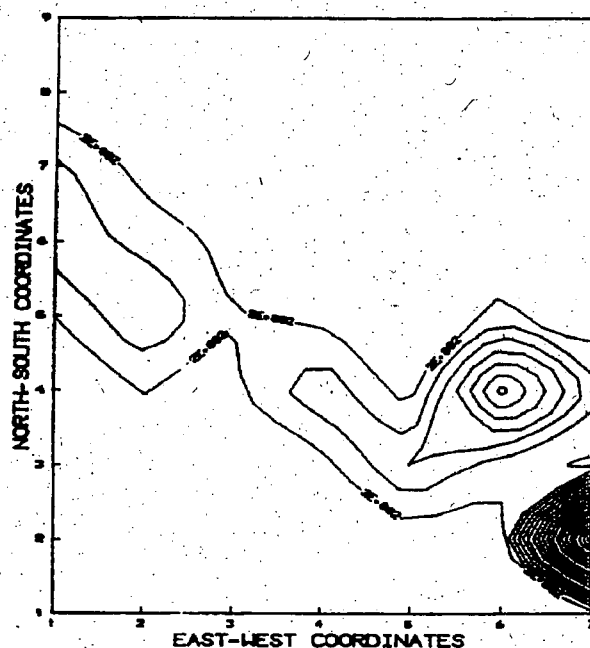
Contour maps are useful for depicting contaminant concentration values throughout a site. Contour mapping requires an accurate, to-scale basemap of the site. After data posting sample values on the basemap, insert contour lines (or isopleths) at a specified contour interval, interpolating values

between sample points. Contour lines can be drawn manually or be generated by computer using contouring software. Although the software makes the contouring process easier, computer programs have a limitation: they may interpolate between all data points, attempting to fit a contour interval to the full range of data values. This can result in a contour map that does not accurately represent general site contaminant trends. Typical emergency or early action sites have low concentration/non-detect areas and hot spots. Computer contouring programs may represent these features as in Figure 16 which illustrates a site that has a 4000 mg/kg hot spot. Because there is a large difference in concentration between the hot spot and the surrounding area, the computer contouring program used a contour interval that eliminated most of the subtle site features and general trends. However, if that same hot spot concentration value is posted at a reduced value, then the contouring program can select a more appropriate contour interval to better illustrate the general site trends. Figure 17 depicts the same site as in Figure 16, but the hot spot concentration value has been arbitrarily posted at 1400 mg/kg. The map was recontoured and the contouring program selected a contour interval that resulted in a map which enhanced the subtle detail and general site contaminant trends.

6.5 STATISTICAL GRAPHICS

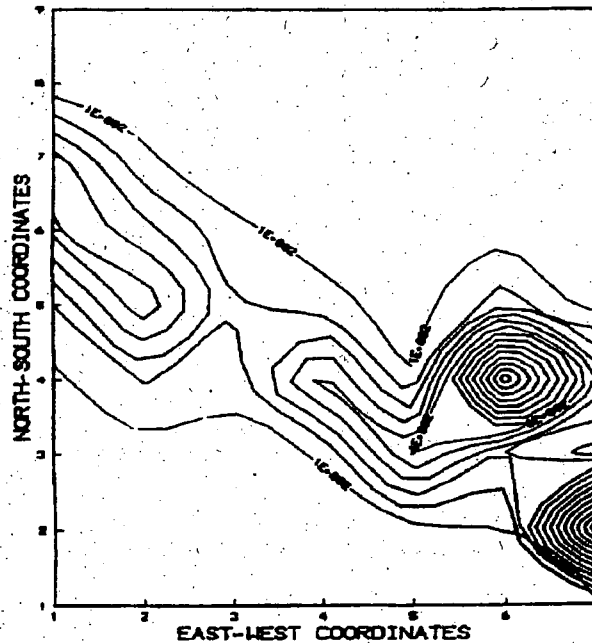
The distribution or spread of the data set is important in determining which statistical techniques to use. Common statistical analyses such as the t-test relies on normally distributed data. The histogram is a statistical bar graph which displays the distribution of a data set. A normally distributed data set takes the shape of a bell curve, with the mean and median close together about halfway between the maximum and minimum values. A probability plot depicts cumulative percent against the concentration of the contaminant of concern. A normally distributed data set, when plotted as a probability plot, would appear as a straight line. Use a histogram or probability plot to see trends and anomalies in the data prior to conducting more rigorous forms of statistical analysis.

Figure 16: Computer-Generated Contour Map (4000 mg/kg Hot Spot)
ABC Plating Site



Total Chromium Concentration
Units = mg/kg
Contour Interval = 100 mg/kg
Includes 4000 mg/kg Hot Spot

Figure 17: Computer-Generated Contour Map (1400 mg/kg Hot Spot)
ABC Plating Site



Total Chromium Concentration
Units = mg/kg
Contour Interval = 100 mg/kg
Includes 1400 mg/kg Hot Spot

1400 mg/kg hot spot is substituted for
4000 mg/kg hot spot

6.6 GEOSTATISTICS

Geostatistical methods are useful for data analysis and presentation. The characteristic feature of geostatistics is the use of variograms to quantify and model the spatial relationship between values at different sampling locations and for interpolating (e.g., kriging) estimated values across a site. The geostatistical analysis can be broken down into two phases. First, a model is developed that describes the spatial relationship between sample locations on the basis of a plot of spatial variance versus the distance between pairs of samples. This plot is called a variogram. Second, the spatial relationship modeled by the variogram is used to compute a weighted-average interpolation of the data. The result of geostatistical mapping by data interpolation is a contour map that represents estimates of values across a site, and maps depicting potential error in the estimates. The error maps are useful for deciding if additional samples are needed and for calculating best or worst-case scenarios for site cleanup. More information on geostatistics can be found in U.S. EPA, September 1988b and U.S. EPA, 1990. GeoEAS and GEOPACK, geostatistical environmental assessment software packages developed by U.S. EPA, can greatly assist with geostatistical analysis methods.

6.7 RECOMMENDED DATA INTERPRETATION METHODS

The data interpretation method chosen depends on project-specific considerations, such as the number of sampling locations and their associated range in values. A site depicting extremely low data values (e.g., non-detects) with significantly higher values (e.g., 5,000 ppm) from neighboring hot spots, with little or no concentration gradient in-between, does not lend itself to contouring and geostatistics, specifically the development of variograms. However, data posting would be useful at such a site to illustrate hot spot and clean areas. Conversely, geostatistics and contour mapping, as well as data-posting, can be applied to site data with a wide distribution of values (i.e., depicting a "bell shaped" curve) with beneficial results.

6.8 UTILIZATION OF DATA

When conducting search sampling to determine the locations of hot spots (as discussed in Section 2.9), analyze the data using one of the methods discussed in this chapter. For each node that is determined to be close to or above the action level, the following procedure is recommended.

Investigate all neighboring grid cells to determine which areas must be excavated and/or treated. From each grid cell, take a composite sample consisting of four or more aliquots, using the procedure described in Section 2.11.6. Grid cells with contaminant concentrations significantly above the action level (e.g., 20%) should be marked for removal. Grid cells with contaminant concentrations significantly less than the action level should be designated as clean. For grid cells with contaminant concentrations close to the action level, it is recommended that additional sampling be done within that grid cell to determine whether it is truly a hot spot, or whether the analytical result is due to sampling and/or analytical procedural error. If additional sampling is to be performed, one of the following methods should be considered:

- Collect a minimum of four grab samples within the grid cell in question. Use these samples to develop a 95% confidence interval around the mean concentration. If the action level falls within or below this confidence interval, then consider removal/treatment of the soil within that grid cell. More information on confidence intervals and standard deviation can be found in Gilbert, 1987.
- Collect additional composite samples from the grid cells in question using the technique discussed in Section 2.11.6. From these additional samples, determine the need for removal/treatment.

These two practical approaches help to determine the total error associated with collecting a sample from a non-homogeneous site. Total error includes design error, sampling error, non-homogeneous sampling error, and analytical error.

If additional sampling is being considered, weigh the cost-effectiveness of collecting the additional samples versus removing the soil from the areas in question. This decision must be made on a site-by-site basis.

After removal/treatment of the contaminated soil, re-investigate the grid cells to verify cleanup below the action level. Each grid cell that had soil removed must either be composite sampled again, or have multiple grab samples collected with a 95% confidence interval set up again. Again, this decision must be made on a site-by-site basis. The methodology should be repeated until all grid cells are determined to have soil concentrations below the action level.

6.9 EXAMPLE SITE

The Phase 2 XRF/atomic absorption (AA) data were examined to determine the appropriate data interpretation method to use. A histogram was generated to illustrate the distribution of the data as depicted in Figure 18. The histogram showed an uneven distribution of the data with most values less than 50 (approximately 4 on the LN scale of the histogram). Also, the presence of a single data point of 4000 (8 on the LN scale) was shown on the histogram. The data were initially posted as illustrated in Figures 19 and 20. Data posting was performed manually to give the OSC a quick depiction of the general site contamination trends. A contour mapping program was used to generate contours based on the posted data. Figure 16 illustrates the results of contouring with the 4000 mg/kg hot spot included. This contour map exaggerated the hot spot while eliminating the subtle site features and contaminant trends. Figure 17 depicts the same site data with the hot spot arbitrarily reduced to 1400 mg/kg. The resulting contour map enhanced more of the subtle site features and trends while reducing the effects of the hot spot.



AA concentrations predicted by the regression equations were kriged and contoured using Geo-EAS (Figures 21 and 22). Both the kriged contours and the data posting showed the same general site contaminant trends. However, data posting gave a more representative depiction of actual levels of contamination and the OSC used data posting for decision-making.

For each node with chromium concentrations close to or above the 100 ppm action level, the adjacent grid cells were further investigated. Composite samples consisting of four aliquots of soil were taken from within each grid cell in question and analyzed. If the soil concentration level was significantly below 100 ppm of chromium, the cell was designated as clean. Each cell that had a soil concentration level well above the action level was marked for removal/treatment. Any cells having soil concentrations close to the action level were sampled further using the compositing method to better quantify the actual contaminant concentration. Since the surrounding area is residential, on-site landfilling was not considered a viable treatment option. To expedite treatment/disposal, all excavated soil from contaminated cells was stockpiled on site until treatment/disposal could be accomplished under a fixed-price contract. The stockpile, placed in the area of the most highly contaminated grid cells (where the lagoons were located), was covered until treatment/disposal could be arranged. Cleanup was verified with composite sampling in the excavated cells. Results of the composite sampling were compared with the action level to verify cleanup. All action levels were met. The excavation pits were filled with stone and clean soil, covered with topsoil, graded and seeded.

Figure 18: Histogram of Surface Chromium Concentrations
ABC Plating Site

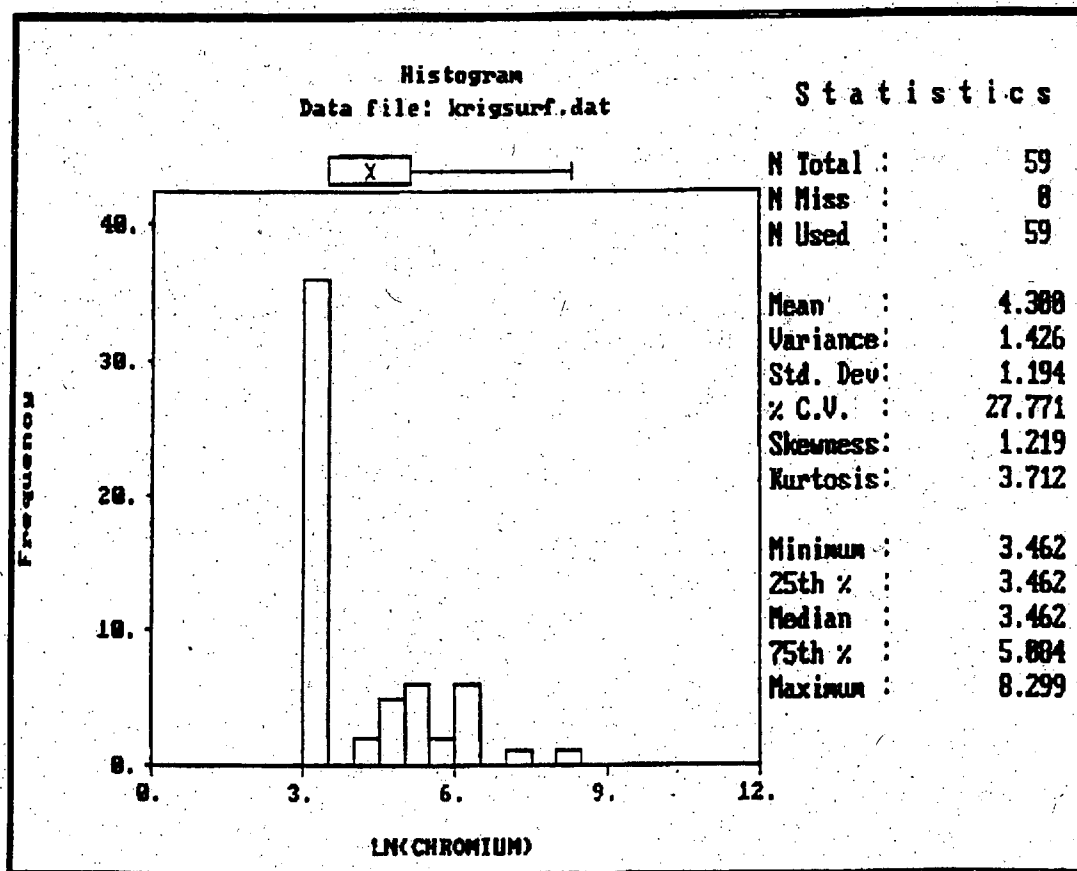


Figure 19: Phase 2 Surface Data Posting for Chromium
ABC Plating Site

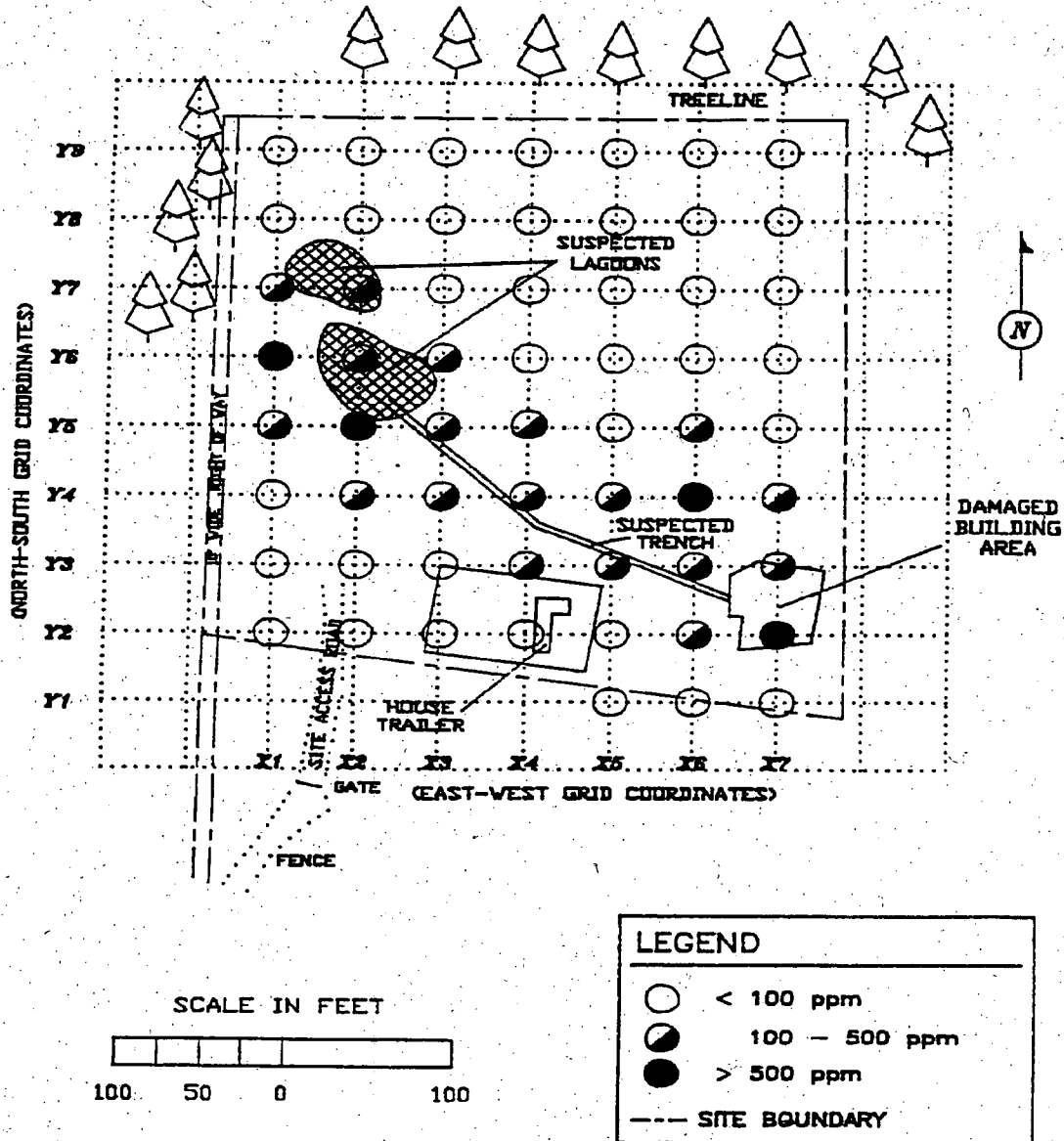


Figure 20: Phase 2 Subsurface Data Posting for Chromium
ABC Plating Site

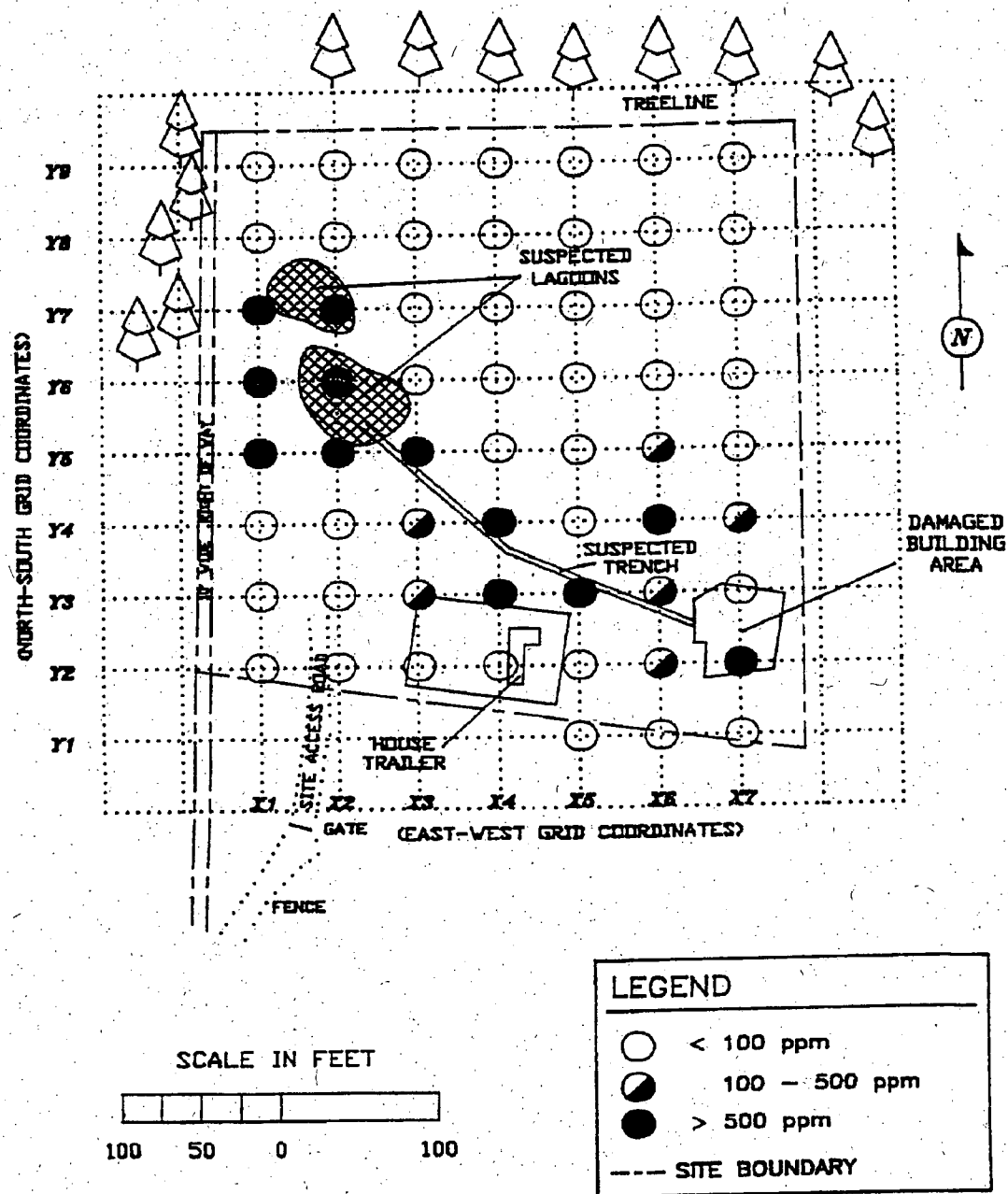


Figure 21: Contour Map of Surface Chromium Data (ppm)
ABC Plating Site

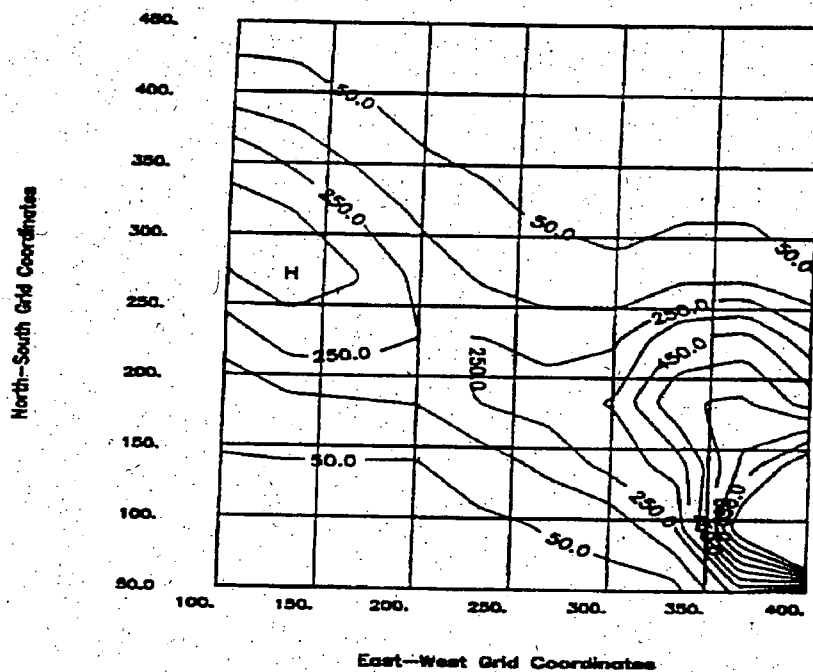
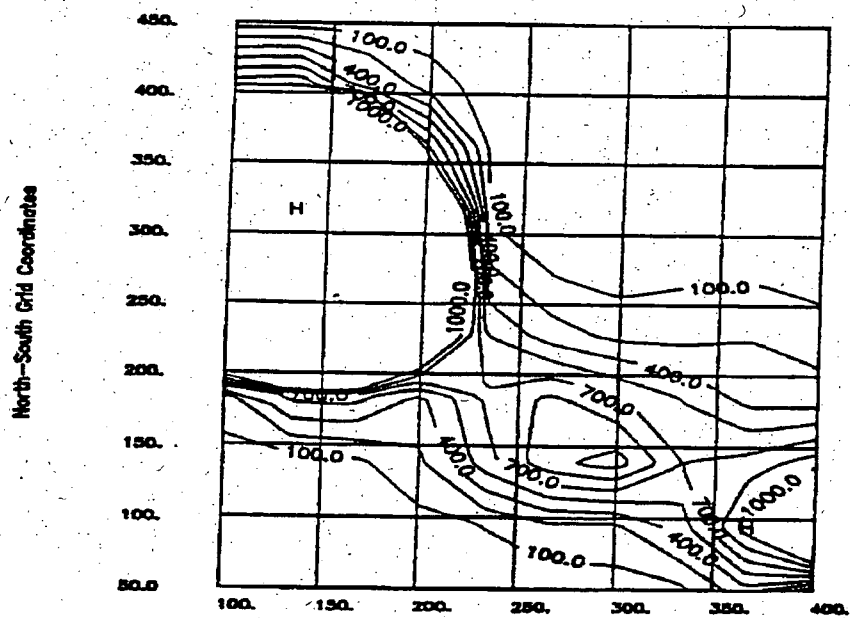


Figure 22: Contour Map of Subsurface Chromium Data (ppm)
ABC Plating Site



APPENDIX A -- EXAMPLE OF FLOW DIAGRAM FOR CONCEPTUAL SITE MODEL

Figure A-1

Migration Routes of a Gas Contaminant from Origin to Receptor

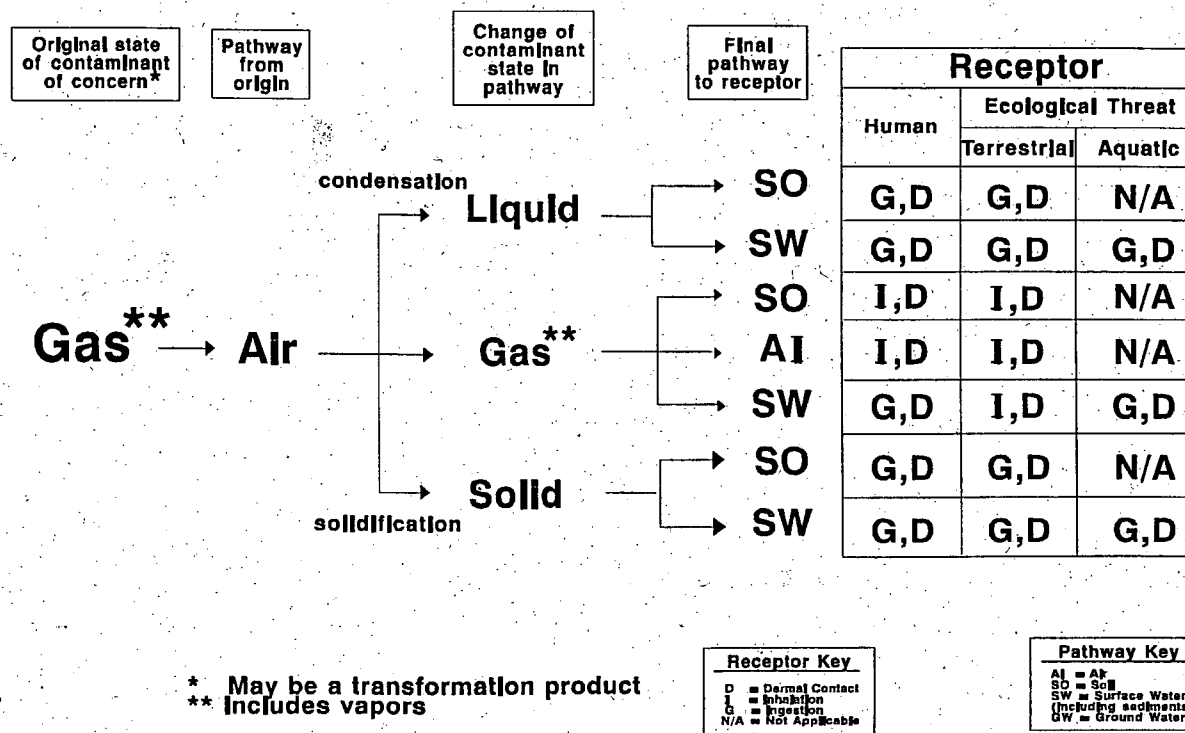


Figure A-2

Migration Routes of a Liquid Contaminant from Origin to Receptor

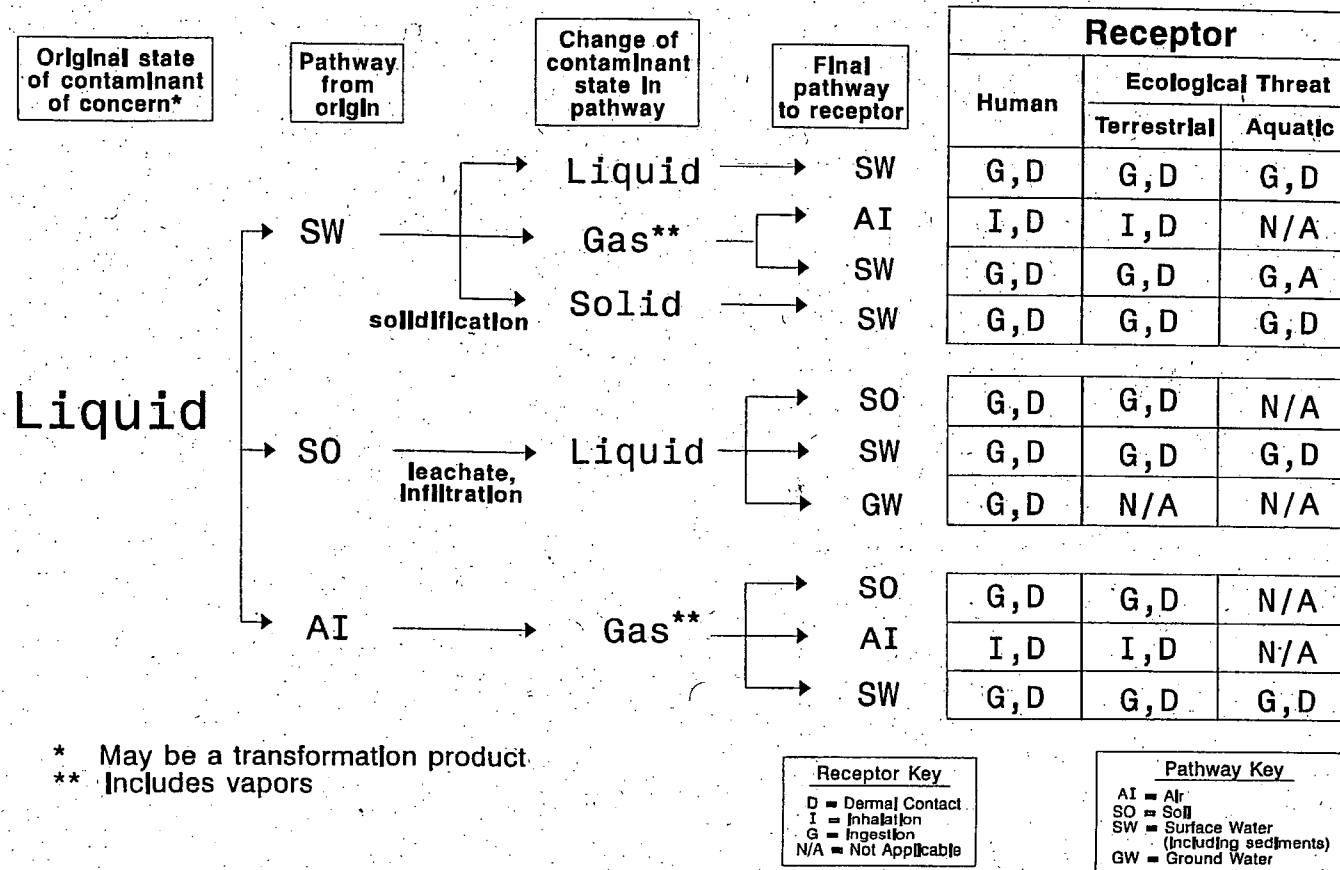
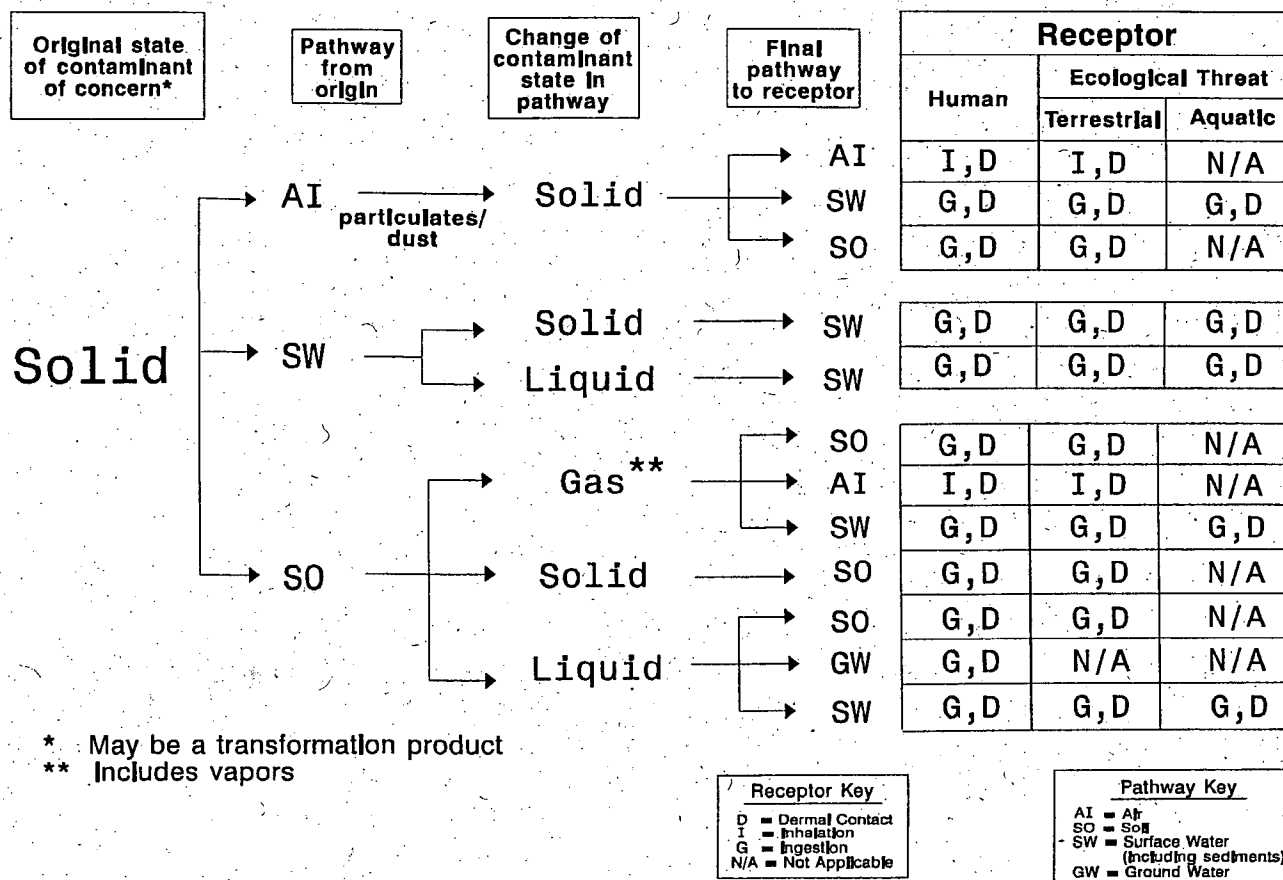


Figure A-3

Migration Routes of a Solid Contaminant from Origin to Receptor



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APPENDIX D

**U.S. EPA (Environmental Protection Agency)
Environmental Response Team (ERT)
Standard Operating Procedure (SOP) #2012: *Soil Sampling*;
from the *Compendium of ERT Soil Sampling and Surface Geophysics Procedures*
OSWER Directive 9360.4-02
Interim Final EPA/540/P-91/006**

Office of Emergency and Remedial Response (OERR), Washington, DC

January 1991

2.0 SOIL SAMPLING: SOP #2012

2.1 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for collecting representative soil samples. Analysis of soil samples may determine whether concentrations of specific soil pollutants exceed established action levels, or if the concentrations of soil pollutants present a risk to public health, welfare, or the environment.

2.2 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of sample required (disturbed versus undisturbed), and the type of soil. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, a trier, a split-spoon, or, if required, a backhoe.

2.3 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Refrigeration to 4°C, supplemented by a minimal holding time, is usually the best approach.

2.4 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems associated with soil sampling. These include cross-contamination of samples and improper sample collection. Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required,

resulting in variable, non-representative results.

2.5 EQUIPMENT/APPARATUS

- sampling plan
- maps/plot plan
- safety equipment, as specified in the health and safety plan
- compass
- tape measure
- survey stakes or flags
- camera and film
- stainless steel, plastic, or other appropriate homogenization bucket or bowl
- 1-quart mason jars w/Teflon liners
- Ziploc plastic bags
- logbook
- labels
- chain of custody forms and seals
- field data sheets
- cooler(s)
- ice
- decontamination supplies/equipment
- canvas or plastic sheet
- spade or shovel
- spatula
- scoop
- plastic or stainless steel spoons
- trowel
- continuous flight (screw) auger
- bucket auger
- post hole auger
- extension rods
- T-handle
- sampling trier
- thin-wall tube sampler
- Vehimeyer soil sampler outfit
 - tubes
 - points
 - drive head
 - drop hammer
 - puller jack and grip
- backhoe

2.6 REAGENTS

Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in

2.7 PROCEDURES

2.7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules, and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, buoys, or flagging to identify and mark all sampling locations. Consider specific site factors, including extent and nature of contaminant, when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations will be utility-cleared by the property owner prior to soil sampling.

2.7.2 Sample Collection

Surface Soil Samples

Collect samples from near-surface soil with tools such as spades, shovels, and scoops. Surface material can be removed to the required depth with this equipment, then a stainless steel or plastic scoop can be used to collect the sample.

This method can be used in most soil types but is limited to sampling near surface areas. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sampling team member. The use of a flat, pointed mason trowel to cut a block of the desired soil can be helpful when undisturbed profiles are required. A stainless steel scoop, lab spoon, or plastic spoon will suffice in most other

applications. Avoid the use of devices plated with chrome or other materials. Plating is particularly common with garden implements such as potting trowels.

Follow these procedures to collect surface soil samples.

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with Augers and Thin-Wall Tube Samplers

This system consists of an auger, a series of extensions, a "T" handle, and a thin-wall tube sampler (Appendix A, Figure 1). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin-wall tube sampler. The system is then lowered down the borehole, and driven into the soil at the completion depth. The system is withdrawn and the core collected from the thin-wall tube sampler.

Several types of augers are available. These include: bucket, continuous flight (screw), and posthole augers. Bucket augers are better for direct

sample recovery since they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights, which are usually at 5-foot intervals. The continuous flight augers are satisfactory for use when a composite of the complete soil column is desired. Posthole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil.

Follow these procedures for collecting soil samples with the auger and a thin-wall tube sampler.

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first 3 to 6 inches of surface soil for an area approximately 6 inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from boring. When sampling directly from the auger, collect sample after the auger is removed from boring and proceed to Step 10.
5. Remove auger tip from drill rods and replace with a pre-cleaned thin-wall tube sampler. Install proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Care should be taken to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container(s). Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into the appropriate, labeled container(s) and secure the cap(s) tightly.
11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

Sampling at Depth with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

Follow these procedures to collect soil samples with a sampling trier.

1. Insert the trier (Appendix A, Figure 2) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.

3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly.

Sampling at Depth with a Split Spoon (Barrel) Sampler

The procedure for split spoon sampling describes the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split tube sampling is performed to gain geologic information, all work should be performed in accordance with ASTM D 1586-67 (reapproved 1974).

Follow these procedures for collecting soil samples with a split spoon.

1. Assemble the sampler by aligning both sides of the barrel and then screwing the bit onto the bottom and the heavier head piece onto the top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a sledge hammer or well ring, if available, drive the tube. Do not drive past the bottom of the head piece or compression of the

sample will result.

4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in diameters of 2 and 3 1/2 inches. However, in order to obtain the required sample volume, use of a larger barrel may be required.
6. Without disturbing the core, transfer it to an appropriate labeled sample container(s) and seal tightly.

Test Pit/Trench Excavation

These relatively large excavations are used to remove sections of soil, when detailed examination of soil characteristics (horizontal structure, color, etc.) are required. It is the least cost effective sampling method due to the relatively high cost of backhoe operation.

Follow these procedures for collecting soil samples from test pit/trench excavations.

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of utility lines and poles (subsurface as well as above surface).
2. Using the backhoe, dig a trench to approximately 3 feet in width and approximately 1 foot below the cleared sampling location. Place removed or excavated soils on plastic sheets. Trenches greater than 5 feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
3. Use a shovel to remove a 1- to 2-inch layer of soil from the vertical face of the pit where sampling is to be done.
4. Take samples using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling.

to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.

5. If volatile organic analysis is to be performed, transfer a portion of the sample directly into an appropriate, labeled sample container(s) with a stainless steel lab spoon, plastic lab spoon, or equivalent and secure the cap(s) tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into an appropriate, labeled container(s) and secure the cap(s) tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled container(s) and secure the cap(s) tightly.
6. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

2.8 CALCULATIONS

This section is not applicable to this SOP.

2.9 QUALITY ASSURANCE/ QUALITY CONTROL

There are no specific quality assurance activities which apply to the implementation of these procedures. However, the following QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation, and they must be documented.

2.10 DATA VALIDATION

This section is not applicable to this SOP.

2.11 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and specific health and safety procedures.

APPENDIX E

**U.S. EPA, Region II
Division of Environmental Science and Assessment
Hazardous Waste Support Branch**

**SOP # MAL-3
Revision# 3**

***Determination of Trace Metals in aqueous, soil, sediment and Sludge Samples
By Inductively Coupled Plasma-Mass Spectrometry***

January 2008



STANDARD OPERATING PROCEDURE

**DETERMINATION OF TRACE METALS IN AQUEOUS,
SOIL, SEDIMENT AND SLUDGE SAMPLES BY
INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY**

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U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 2
DIVISION OF ENVIRONMENTAL SCIENCE AND ASSESSMENT
HAZARDOUS WASTE SUPPORT BRANCH
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DETERMINATION OF TRACE METALS IN AQUEOUS, SOIL/SEDIMENT AND SLUDGE SAMPLES BY INDUCED COUPLED PLASMA- MASS SPECTROMETRY

1. Scope and Application

- 1.1 Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) is an analytical technique for performing the rapid determination of metals at trace level concentrations. In accordance, this Standard Operating Procedure (SOP) describes the inorganic analysis of environmental sample digestates for metals by ICP-MS. It is derived from the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Method 6020A, Revision 1 January 1998*, and the *U.S. EPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration ILMO5.3, March 2004*. This SOP is applicable for the determination of the 23 routine Target Analyte List (TAL) metals found in section 1.3 of this document. It is important to note that the determination of additional metals can be made using an appropriate set of standards once instrument performance criteria for non-routine analytes are established. Instrument detection limits, sensitivities and linear ranges can vary depending upon instrumentation, matrices and/or operating conditions.
- 1.2 Use of this SOP should be regulated to analysts who are knowledgeable in the mitigation of spectral, chemical, and physical interferences inherent to ICP-MS analyses. In practice, performance data will for the most part exceed that of either atomic absorption or conventional ICP spectrophotometry for the listed elements. In relatively simple matrices, instrument detection limits are generally be less than 5.0 $\mu\text{g/L}$ for most target analyte list metals. Desensitized major elements and/or those which are less sensitive (selenium & arsenic) may be 1.0 $\mu\text{g/L}$ or higher.
- 1.3 An appropriate internal standard is required for the quantitation of each analyte determined by ICP-MS. The recommended internal standards are ^6Li , ^{45}Sc , ^{115}In , and ^{159}Tb are to be used for analysis. To minimize the potential interference from lithium inherent to the sample, the internal standard should have an enriched abundance of ^6Li . Similarly, other elements may be required for use as internal standards when samples are known to contain significant inherent amounts of the recommended internal standards.
- 1.4 ICP-MS has been demonstrated for use in the determination of over 60 metals in a variety of environmental sample matrices. For these purposes, this SOP is used to identify and measure the following 23 routine Target Analyte List (TAL) metals:

<u>Element</u>	<u>CAS No.</u>
Aluminum (Al)	7429-90-5
Antimony (Sb)	7440-36-0
Arsenic (As)	7440-38-2
Barium (Ba)	7440-39-3
Beryllium (Be)	7440-41-7
Cadmium (Cd)	7440-43-9
Calcium (Ca)	7440-70-2
Chromium (Cr)	7440-47-3
Cobalt (Co)	7440-48-4
Copper (Cu)	7440-50-8
Iron (Fe)	7439-89-6
Lead (Pb)	7439-92-1
Magnesium (Mg)	7439-95-4
Manganese (Mn)	7439-96-5
Mercury (Hg)	7439-97-6
Nickel (Ni)	7440-02-0
Potassium (K)	7440-09-7
Selenium (Se)	7782-49-2
Silver (Ag)	7440-22-4
Sodium (Na)	7440-23-5
Thallium (Tl)	7440-28-0
Vanadium (V)	7440-62-2
Zinc (Zn)	7440-66-6

2. Summary of SOP

This SOP delineates the multi-elemental analysis of environmental samples for the determination of trace metal contaminants by ICP-MS. Prior to analysis, samples are first digested using an appropriate preparation procedure. Analytes isolated in the liquid sample digestate are nebulized to form an aerosol for aspiration into a radio-frequency plasma for desolvation, atomization, and ionization. The resulting ions produced by the high temperature of the plasma are then extracted by a differentially pumped vacuum interface and introduced into a mass spectrometer. The ions are then sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. A data handling system is then relied upon to process the ion information acquired by the mass spectrometer for reporting. Interferences related to this instrumental technique are always assessed and valid corrections applied or the data flagged to indicate problems. Corrections can include compensating for background ions contributed by either the plasma gas, reagents, and/or the sample matrix. Instrument drift, including variations in response, are corrected for by use of internal standards.

- 2.1 An aliquot of a well mixed, homogenous aqueous or soil sample is accurately weighed or measured for sample processing. For total recoverable analysis of a solid or an aqueous sample containing undissolved material, elements are first solubilized by gentle refluxing with HNO_3 and HCl . After cooling, the sample is made up to volume, mixed and filtered (if necessary) prior to analysis. For the determination of dissolved elements in a filtered aqueous sample aliquot, or for the "direct analysis" total recoverable determination of elements in drinking water where sample turbidity is less than 1 NTU, the sample is made ready for analysis by the appropriate addition of HNO_3 and then diluted to a predetermined volume and mixed before analysis.
- 2.2 The method describes the multi-element determination of trace element by ICP-MS. Sample material in solution is introduced by pneumatic nebulization into a radio-frequency plasma where energy transfer processes cause desolvation, atomization and ionization. The ions are extracted from the plasma through a differentially pumped vacuum interface and separated on the basis of their mass-to-charge ratio by a quadrupole mass spectrometer having a minimum resolution capability of 1 amu peak width at 5% peak height. The ions transmitted through the quadrupole are detected by an electron multiplier and the ion information processed by a data handling system. Interferences relating to the technique must be recognized and corrected for. Such corrections must include compensation for isobaric elemental interferences and interferences from polyatomic ions derived from the plasma gas, reagents or sample matrix. Instrumental drift as well as suppressions or enhancements of instrument response caused by the sample matrix must be corrected for by the use of internal standards.

3. Definitions

The following glossary of terms, and specialized forms are utilized within this SOP to facilitate its application:

3.1 Glossary of terms

AMU	Atomic Mass Unit.
ARAR	Applicable or Relevant and Appropriate Requirement.
ASTM	American Society of Testing and Materials.
BDAT	Best Demonstrated Available Technology.
CCB	Continuing Calibration Blank.
CCV	Continuing Calibration Verification.
CERCLA	Comprehensive Environmental Response Compensation and Liability Act.
CFR	Code of Federal Regulations.
CLP	Contract Laboratory Program.
COC	Chain of Custody.
CRDL	Contract Required Detection Limit.
DQO	Data Quality Objective.

FIELD SCREENING

Analyses characterized by the use of portable analytical instruments which can provide on-site real time data to optimize sampling point location and support health and safety.

GLP	Good Laboratory Practices.
HASP	Health and Safety Plan.
HWSB	Hazardous Waste Support Branch.
ICB	Initial Calibration Blank.
ICP-MS	Inductively Coupled Plasma - Mass Spectrometer.
ICS	Interference Check Sample.
ICV	Initial Calibration Verification.
IDL	Instrument Detection Limit.
I Std.	Internal Standard.
LCS	Laboratory Control Sample.
MCAWW	Methods for Chemical Analysis of Water and Wastes.
MD	Matrix Duplicate.
MS	Matrix Spike.
MSDS	Materials Safety Data Sheets.
OSC	On-Scene Coordinator.
OSHA	Occupational Safety and Health Administration.
PARCC	Precision, Accuracy, Representativeness, Comparability and Completeness.
PM	Project Manager (OSC, RPM, SAM, etc.)
PPB	Parts Per Billion
PPE	Personal Protective Equipment.
PPM	Parts Per Million.
PRP	Potentially Responsible Party.
QA/QC	Quality Assurance/Quality Control.
QAPP	Quality Assurance Project Plan.
QAO	Quality Assurance Officer.
RCRA	Resource Conservative and Recovery Act.
RSD	Relative Standard Deviation.
RPM	Remedial Project Manager.
SAM	Site Assessment Manager.
SCST	Superfund Contract Support Team.
SOP	Standard Operating Procedure.
SW-846	Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.
TAL	Target Analyte List.
TSA	Technical Systems Audit.
U.S. EPA	United States Environmental Protection Agency.
X-Cal	Cross Calibration.

4. Interferences

4.1 When determining trace elements by ICP-MS, there are a number of potential interferences which can contribute to inaccuracies in the resulting analytical data. Understanding these variables are essential if appropriate steps are to be taken for mitigating any and all potential interference effects. In practice, the development and implementation of proper work practices are therefore relied upon to limit potential interferences. This approach involves incorporating rigorous Quality Assurance/Quality Control (QA/QC) protocols into this SOP as a basis for conducting data collection efforts. These specific work procedures for mitigating the most common interferences through the implementation of QA/QC protocols into the overall data collection scheme are as follows:

4.2 Isobaric elemental interferences occur when isotopes of other elements form atomic ions with the same nominal mass to charge ratio (m/z) of a target analyte and go unresolved by the mass spectrometer. This circumstance necessitates that an appropriate data system be used to correct for these interferences. This will typically involve determining the signal for another isotope of the interfering element and subtracting its signal from the analyte isotope signal. It is important to note that although this type of interference is uncommon, it can be most difficult to correct. Samples with significant isobaric elemental interference problems can require resolution improvement, matrix separation, analysis using another verified isotope, and/or use of another method.

In order to correct this anomaly the ICP-MS manufacturer has incorporated a formula to determine the signals for the differing isotopes and subtracting the interfering signal from the isotope signal.

4.3 Physical interferences are generally considered to be effects associated with the sample nebulization and transport processes. Such properties as change in viscosity and surface tension can cause significant inaccuracies especially in samples which may contain high dissolved solids and/or acid concentrations. The use of a peristaltic pump may lessen these interferences. If these types of interferences are operative, they must be reduced by dilution of the sample and/or utilization of standard addition techniques. Another problem which can occur from high dissolved solids is salt buildup at the tip of the nebulizer. This affects aerosol flow-rate causing instrumental drift. Wetting the argon prior to nebulization, the use of a tip washer, or sample dilution have been used to control this problem. Also, it has been reported that better control of the argon flow rate improves instrument performance. This accomplished with the use of mass flow controllers.

4.4 Chemical interferences are characterized by molecular compound formation, ionization effects and solute vaporization effects. Normally these effects are not pronounced with the ICP technique, however, if observed they can be minimized by careful selection of operating conditions, by buffering of the sample, by matrix matching, and by standard addition procedures. These types of interferences can be

highly dependent on matrix type and specific analyte element.

- 4.5 It is recommended that whenever a new or unusual sample matrix is encountered, a series of tests be performed prior to reporting concentration data for analyte elements. These tests, as outlined below will ensure the analyst that neither positive nor negative interference effects are operative on any of the analyte elements thereby disturbing the accuracy of the reported values.

Serial dilution - If the analyte concentration is sufficiently high (minimally a factor of 10 above the instrumental detection limit after dilution), an analysis of a dilution should agree within 5% of the original determination (Or within some acceptable control limit that has been established for that matrix). If not, a chemical or physical interference effect should be suspected.

Spike addition - Matrix spike (MS) and matrix spike duplicate (MSD) are prepared to demonstrate matrix effects upon analyte recovery and reproducibility. MS and MSD are prepared and run according to the EPA Region 2 ICP preparation log and the EPA Region 2 Inorganic QA/QC Plan and Section 13.7.

Comparison with alternate method of analysis - When investigating a new sample matrix, comparison tests may be performed with other analytical techniques such as atomic-absorption spectrometry, or other approved methodology.

5. Health and Safety

The toxicity and carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure to these compounds should be minimized by good laboratory practices. Normally accepted laboratory safety practices should be followed during reagent preparation and instrument operation. Always wear safety glasses or full-face shield for eye protection when working with these reagents. Each laboratory is responsible for maintaining a current safety plan and a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this SOP.

When conducting on-site investigations, the U.S. EPA Region 2 Mobile Analytical Laboratory will operate to provide "real-time" quantitative environmental measurement data directly in the field. To perform field work of this nature, laboratory personnel must always be aware of potential occupational environmental hazards. In practice, not all of the potential environmental hazards which may be inherent to a site mobilization of the laboratory can be readily anticipated. However, to mitigate these circumstances, laboratory personnel are to learn, follow, and enforce all published rules governing occupational health and safety. To facilitate these efforts, field certification and PPE requirements are administered according to the protocols set forth in the current U.S. EPA Region 2 *Edison*

Health and Safety Manual.

Although the hazards of most elements used or determined with this SOP are not precisely defined, arsenic, mercury, and lead are known to cause adverse health effects. For information purposes, an inventory of all chemical Material Safety Data Sheets (MSDSs) are kept on in a visible folder on the wall in the Mobile Analytical laboratory. Each calibration standard and environmental sample are to be handled with caution because of potential health hazards. Exposures should therefore be kept to a minimum by following appropriate laboratory safety protocols (working inside a fume hood, donning laboratory coats, gloves, safety glasses & shoes, etc.). To ensure laboratory operations are conducted in a safe and responsible manner, the *U.S. EPA Region 2 Mobile Analytical Laboratory Health and Safety Plan (HASP)* is put forward to define these policies and procedures.

6. Apparatus and Materials

- 6.1 A sequential inductively coupled plasma mass spectrometer.
 - 6.1.1 Quadrupole - capable of scanning the mass range 5 - 250 amu in 100 ms.
 - 6.1.2 RF generator - a 1.6 kW, 27.12 MHz crystal controlled solid state.
 - 6.1.3 Variable-speed peristaltic pump - for solution delivery to the nebulizer.
 - 6.1.4 Mass-flow controller on the nebulizer gas supply - a water-cooled spray chamber.
 - 6.1.5 Vacuum system - two turbo molecular pumps, with ceramic bearings that generate the vacuum in the intermediate and analyzer stages.
 - 6.1.6 High purity grade (99.99%) liquid argon.
- 6.2 Analytical balance - capable to measure to 0.1 mg.
- 6.3 Block digester - A temperature adjustable block digester capable of maintaining a temperature of 95°C and equipped with 50-mL constricted digestion tubes.
- 6.4 Pipetter - An air displacement pipetter capable of delivering volumes ranging from 1.0 to 1000 µL and 1.0 to 10 mL with an assortment of high quality disposable pipet tips.
- 6.5 Labware - See Section 6.10 of EPA Method 200.8 Rev. 5.4
Important Note: Chromic acid must not be used for cleaning glassware.
 - 6.5.1 Glassware - Volumetric flask, graduated cylinders, funnels and centrifuge tubes (glass and/or metal free plastic).
 - 6.5.2 Assorted calibrated battery operated pipettes.
 - 6.5.3 Narrow and wide-mouth storage bottles, FEP (fluorinated ethylene propylene) with ETFE (ethylene tetrafluorethylene) screw closure, 125-mL to 500-mL capacities.
 - 6.5.4 One-piece stem FEP wash bottle with screw closure, 125-mL capacity.
- 6.6 Convection Oven - A gravity convection drying oven with thermostatic control

capable of maintaining $60^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

- 6.7 Mortar and Pestle - Mortar and pestle, ceramic or nonmetallic material.
- 6.8 Sieve - Polypropylene sieve, 5-mesh (4mm opening).

7. Reagents and Solutions

7.1 Reagents

All acids used for this method must be of ultra high purity grade suitable for ultra trace metals analysis. HNO_3 is preferred for ICP-MS in order to minimize polyatomic ion interferences. Several polyatomic ion interferences result when HCl is used (see Table 4), however, it should be noted that HCl is required to maintain stability in solutions containing Sb and Ag . When HCl is used, corrections for the chloride polyatomic ion interferences must be applied to all affected data.

- 7.1.1 Nitric acid, concentrated - HNO_3 (HNO_3 , Double Distilled, sp. gr. 1.408 or equivalent)
- 7.1.2 Hydrochloric acid, concentrated - HCl (HCl , 30-35% Reagent ACS, sg. gr. 1.160 or equivalent)
- 7.1.3 Reagent grade water – ASTM Type I Deionized Water

7.2 Solutions

- 7.2.1 Mixed calibration standard solutions. Prepare mixed calibration standard solutions by combining appropriate volumes of stock solutions in 1000ml volumetric flasks. Prepare standard concentrations as stated below. Mixed calibration standard matrix is 3% concentrated HCl and 2% concentrated HNO_3 .
- 7.2.2 Standard A Reagent Blank.
- 7.2.3 Standard B - 10 ppm Ba, Ca, Cd, Co, Cu, Mg, Mn, Pb, Zn
100 ppm K
- 7.2.4 Standard C - 10 ppm Al, Be, Fe, Li, Mo, Ni, Ti
100 ppm Na
- 7.2.5 Standard D - 10 ppm As, B, Cr, Se, Sr
- 7.2.6 Standard E - 10 ppm Sb, V – 2 ppm Ag
- 7.2.7 Standards A and E are made daily.

- 7.2.8 Standards B, C, and D are made every 3 months.
- 7.2.9 Initial Calibration Verification (ICV) and Continuing Calibration Verification (CCV) solutions are prepared in 100ml volumetric flasks. The true value for ICV and CCV solutions is 1000 ug/l for all elements except Potassium (60000 ug/l) and Sodium (51000 ug/l).

8. Sample Collection, Preservation, Storage and Holding Time

- 8.1 Sample Collection - Samples must be collected in plastic or glass containers.
- 8.2 Preservation and Storage
 - 8.2.1 Aqueous samples - these samples are preserved in the field to a pH <2 using concentrated HNO₃. The samples are stored at room temperature.
 - 8.2.2 Soil/Sediment/Sludge samples - these samples are preserved in a refrigerator at ≤4°C. Alternatively, the samples may be stored at ≤-20°C in a freezer.
- 8.3 Holding times
 - 8.3.1 Aqueous samples must be prepared and analyzed within six months of collection.
 - 8.3.2 Soil/Sediment/Sludge samples must be digested and analyzed within six months of collection. If soil/sediment samples are stored at ≤-20°C, the holding time is extended. The samples must be prepared within 12 months of collection and analyzed within 6 months of digestion.

9. Sample Preparation

All Environmental samples, e.g., aqueous, soil/sediment are digested in a mixture of acids using the procedures described in the Mobile Laboratories SOP Number MALIPREP. "Digestion of Metals Aqueous, TCLP Extracts, Soil/Sediment" by a block digestion device.

10. Instrument Operating Conditions

10.1 Instrument Conditions

- Forward R.F. Power - 0.9-1.1 kilowatts.
- Reflected RF Power - 5 watts or less.
- Integration time 5.0 sec.
- Incoming Argon pressure 50 psi.
- Argon torch flow - 20 liters/min.
- RF power 1150 W.
- Analysis peristaltic pump rate 40-100 rpm.
- Flush peristaltic pump rate 100-200 rpm.
- Flush time 10-30 sec.
- Cooling water rate - 300-500 ml/min.

10.2 System Tuning/Calibration

Tune/Calibrate the instrument as follows:

- 10.2.1 Tune the instrument by running an both the "Tune A and 6020A Tune solutions through the instrument at a concentration of 10 ppb by following the tuning drop down menus. Assure that the performance report indicates passing conditions and count rates for all elements/isotopes.
- 10.2.2 Conduct a mass calibration by using a 1 - 10 ppb tuning solution.
- 10.2.3 Conduct a detector cross calibration by using 25 ppb tuning solution.

11. Sample Analysis

11.1 Configure the instrument settings to those in Section 10.

11.2 After the plasma has become stable, calibrate the instrument using the mixed calibration standards solution and the calibration blank (Section 7.2.4.1) followed by analysis of the appropriate quality control samples (See Section 11.3 below) and associated environmental samples. The average of three readings is to be used. Flush the system with the rinse blank for a minimum of 60 seconds between each standard.

11.3 Once the calibration standards are analyzed, samples should be analyzed in the same operational manner used in the calibration routine with the rinse blank also being used between all quality control and environmental samples. The routine sample analysis protocol is as follows:

- Calibration Blank
- Mixed Calibration Standards
- ICV
- ICB
- ICS-A
- ICS-AB
- Prep Blank
- LCS1
- Environmental Samples (up to 10)
- Matrix Spike
- CCV
- CCB

NOTE: *Identical amounts of Internal Standards (Section 7.2.3) should be added to all calibration standards, blanks, samples and all other QC samples. (The CCV and CCB must be analyzed after a maximum of 10 samples and at the end of each analysis).*

- 11.4 During the analytical run the laboratory must comply with the appropriate quality control requirements listed in section 14 of this SOP.
- 11.5 Determined sample analyte concentrations that are >90% or more of the Linear Dynamic Range (LDR) limit must be diluted with reagent grade water that has been acidified in the same manner as the calibration blank & reanalyzed.
- 11.6 Perform all appropriate data calculations as described in section 12 of this SOP.

12. Data Analysis and Calculations

See Appendix A for the detailed data calculations

13. Method Performance

An initial demonstration of capability (DOC) must be performed each time there is a significant change in the chemistry of the method, a major modification to an existing instrument, or a new instrument is installed. A DOC is performed by each analyst designated to analyze samples using this method. An annual check must subsequently be performed and documented for each analyst using this method.

13.1 Accuracy and Precision

13.1.1 Initial Demonstration of Capability

An initial demonstration of capability study must be conducted for this method for each analyst using this method. The study consists of the

analysis of four standards which are from a source independent of the standard curve. The results of the standards must be within the acceptance criteria supplied by the manufacturer or within 20% if none are specified. The % RSD should be within 20%. The results of the accuracy and precision study (true value, % recovery, standard deviation and % RSD) are maintained in the Mobile Analytical Laboratory.

13.1.2 Continuing Demonstration of Capability

An annual continuing demonstration of capability study must be performed and documented. It may consist of either successfully analyzing a PT sample or analyzing 2 sets of unknown standards to within control limits as stated in section 13.1.1. The results of the continuing accuracy and precision study (true value, % recovery, standard deviation and % RSD or final report from the PT provider) are maintained by the Quality Assurance Officer for each analyst and are maintained in the Mobile Analytical Laboratory.

13.2 Instrument Detection Limit (IDL)

An IDL Study must be conducted for this method. An IDL is the lowest limit that the instrument can detect. It is determined on samples which have not gone through any sample preparation steps. According to EPA SW-846, inorganic IDLs are determined by multiplying by three the average of the standard deviations obtained on three non-consecutive days from the analysis of blank reagent water solution. The results of the IDL are maintained in the Mobile Analytical Laboratory.

13.3 Linear Dynamic Range (LDR)

The LDR must be determined annually by generating a normal linear calibration curve followed by the analysis of successively higher standard solutions. The results of these standard solutions are used to calculate % recovery. This is conducted until the % recovery fell below 90%. The last standard that had a % recovery of at least 90% is identified as the LDR limit.

The results of the LDR Study are maintained in the Mobile Analytical Laboratory. The LDR results must be below that listed as the upper range in U.S. EPA SW-846 Method 6020A.

14. Quality Control

14.1 Calibration Curve

Acceptance Criteria - All calibration standards, a minimum of 2 standards concentration levels and a blank must have a correlation coefficient ≥ 0.995 .

Corrective Action - If the correlation coefficient is < 0.995 , the calibration is disallowed. The analysis must be terminated, and repeated after correcting the problem.

14.2 Initial Calibration Verification (ICV)

Acceptance Criteria - Analyze the ICV solution, from a separate identifiable source (different vendor or different lot number) than the calibration standards, immediately following each calibration, after every tenth sample (or more frequently, if required) and at the end of the sample run. Analysis of the ICV immediately following calibration must verify that the instrument is within $\pm 10\%$ of calibration. This must be analyzed immediately after the calibration, every ten samples and at the end of the sample run. Analysis of the ICV immediately following calibration must verify that the instrument is within $\pm 10\%$ of calibration.

Corrective Action - If the calibration cannot be verified within the specified limits, analysis must be discontinued and the cause determined and/or in the case of drift the instrument recalibrated.

14.3 Continuing Calibration Verification (CCV)

Acceptance Criteria - Analyze the CCV solution, from the same source as that used for the ICV, after a maximum of ten samples and at the end of the sample run. The results of each CCV solution must $\pm 20\%$ of the true concentration.

Corrective Action - If the calibration cannot be verified within the specified limits, re-analyze the CCV solution. When the results of the second analysis of the CCV solution is not within the acceptance limits, the analysis must be discontinued, the cause determined and the instrument re-calibrated. All samples following the last acceptable CCV solution must be reanalyzed.

14.4 Initial Calibration Blank/Continuing Calibration Blank (ICB/CCB)

Acceptance Criteria - Analyze a calibration blank immediately following each calibration and after every CCV. All ICB/CCBs results must be less than the Reporting Limit.

Corrective Action - If the result of the ICB/CCB is greater than the Reporting Limit (or greater than the negative Reporting Limit), the analysis should be stopped, the problem identified, and the ICB/CCB reanalyzed. If the ICB/CCB results remain greater than the Reporting Limit (or greater than the negative Reporting Limit) the instrument must be recalibrated.

14.5 Preparation Blank (PB) / Method Blank

Acceptance Criteria - The PB results must be less than the Reporting Limit.

Corrective Action - If the result of the PB is greater than the Reporting Limit, then all associated samples with a concentration of less than 10 times the amount found in the PB should be re-prepared and reanalyzed. If the samples cannot be re-prepared, then all affected sample results must be either 1) qualified accordingly, or 2) the reporting limit is raised to the amount found in the sample. Check with the team leader/section chief to determine which option should be used.

Sample results $\geq 10\times$ the amount found in the PB are not considered to be affected by the blank contamination or drift, so no corrective action is needed.

14.6 Laboratory Control Samples (LCS)

14.6.1 Aqueous LCS

Acceptance Criteria - Analyze one aqueous LCS sample with each batch of aqueous samples of 20 or less. The relative percent difference (RPD) of the duplicates should not exceed 20%. Calculate accuracy as percent recovery using the following equation:

$$\% \text{ Recovery} = \frac{\text{Average of 2 LCS's} \times 100}{s}$$

Where; LCS = Laboratory Control Sample
 s = concentration of analytes added to fortify the LCS solution

The % recovery of the LCS must be within $\pm 20\%$ of the true value.

14.6.2 Solid LCS

Acceptance Criteria - Analyze one solid LCS samples with each batch of solid samples of 20 or less. Calculate accuracy as percent recovery using the following equation:

$$\% \text{ Recovery} = \frac{\text{Average of 2 LCS's, mg/Kg} \times 100}{\text{True Value, mg/Kg}}$$

The % recovery of the solid LCS must be within $\pm 20\%$ of the true value or within the limits established by the vendor.

Corrective Action for 14.6.1 and 14.6.2 - If the % recovery or %RPD results are outside the required control limits, the affected samples should be re-prepared and reanalyzed. If the samples cannot be re-prepared, then all affected sample results must be qualified accordingly.

14.7 Matrix Spike (MS) Recovery

Acceptance Criteria - Add a known amount of analytes to one sample per matrix per project or a minimum of 10% whichever is greater. The MS aliquot must be a duplicate of the aliquot used for sample analysis. When possible, the concentration should be the same as that added to the aqueous LCS, but should not exceed the midpoint concentration of the calibration curve. Calculate the percent recovery, corrected for background concentration measured in the unfortified sample aliquot and compare the recoveries to the control limits to the designated matrices. A percent difference of $\pm 20\%$ for aqueous and $\pm 50\%$ for solid/sludge samples is required. Percent recoveries are calculated using the following equation:

R = percent recovery,

$$R = \frac{\{C_s - C\} \times 100}{s}$$

C_s = spiked sample concentration,

C = sample background concentration, and

s = conc. equivalent of metal added to sample.

Corrective Action: If the percent recovery of the MS is outside the required control limits, and the laboratory performance is shown to be in control, the recovery problem encountered is judged to be matrix related, not system related. The native sample result of the sample used to produce the MS must be qualified accordingly.

NOTE: *The % recovery of the MS is not evaluated when the results of the un-spiked sample concentration is $\geq 1.0X$ the level used to spike the sample.*

14.8 Internal Standard Responses

Acceptance Criteria - The absolute response of any one internal standard must not deviate from within the range of 0.60 - 1.87 of the original response in the calibration blank.

Corrective Action - If deviations greater than these are observed, flush the instrument with the rinse blank and monitor the responses in the calibration blank.

If the responses of the internal standards are now within the limit, take a fresh aliquot of the sample, dilute by a further factor of two, add the internal standard and re-analyze. When after flushing the response of the internal standards in the calibration blank are out of limits, terminate the analysis and determine the cause of the drift. Consult the supervisor for further corrective action.

15. Reporting and Validation

15.1 Reporting Limits - The reporting limits are calculated based on the concentration of the lowest calibration standard analyzed. The reporting limits are matrix and dilution dependent. All results are reported to 2 significant figures. Solid matrices are reported on a dry weight basis.

15.2 Sample Data Package - The sample data package should include but not be limited to the following:

1. ICP-MS QA/QC Checklist with all relevant information included;
2. Copies of Log Book entries of Analysis Run Log; Sample Digestion Log, and if required, Sample Percent Solids Log and/or pH Log;
3. Calibration Report;
4. Summary Analysis Form;
5. QC Summary Forms; and
6. Instrument generated sample data

15.3 Laboratory Information Management System (LIMS)

The analyst enters the data in the LIMS under the appropriate analytical codes.

15.4 Data Validation

The data package is given to the reviewer. The review is done by a peer who was not involved in the analysis. Upon completion of the review, including validation of all the appropriate codes in the LIMS for the particular project(s), the data reviewer will sign and date the ICP-MS QA/QC Checklist.

15.5 Data Records

All project records associated with the data package are filed under one designated project file. All other projects associated with the data package are referenced to this designated project file via a "cross reference form". The "cross reference form" is placed in each of the project files that were associated with the data package.

The data package is placed in the bin identified for the designated project file. The records for this designated project file are filed in our locked record cabinets once all data from the project, e.g., non-metal inorganic data, organic data, microbiology data, etc. has been reviewed by the appropriate staff.

16. Pollution Prevention

- 16.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.
- 16.2 The quantity of chemicals purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.
- 16.3 For information about pollution prevention that may be applicable to laboratories and research institutions, consult *Less is Better: Laboratory Chemical and Management for Waste Reduction*, available from the American Chemical Society's Department of Government Relations and Science Policy, 1155 16th Street N. W., Washington D. C. 20036, (202) 872-4477.

17. Waste Management

The U.S. EPA requires that laboratory waste management practices be conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process waste should be characterized and disposed of in an acceptable manner. The Agency urges laboratories to protect the air, water, and land by minimizing and controlling all releases from hoods and bench operations, complying with the letter and spirit of any sewer discharge permits and regulations, and by complying with all solid and hazardous waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management consult the Region 2, SOP G-6, "*Disposal of Samples and Hazardous Wastes*".

18. REFERENCES

- CLP Statement of Work (SOW) document Number ILMO5.3; Low/Medium

Inorganic SOW.

- Edison Facility Safety Manual, USEPA, Region 2, Part 2 - Laboratory Safety for specific guidelines.
- Federal Register Vol. 49, No. 209. October 26, 1984. Appendix B to part 136.
- Quality Assurance/Quality Control Manual. U.S. EPA, Region 2
- U. S. Environmental Protection Agency, Solid Waste 846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Method 6020A *"Induced Coupled Plasma - Mass Spectrometry"* Laboratory Manual, Revision 1, January 1998.
- U.S. Environmental Protection Agency, Region 2, SOP G-6 *"Disposal of Samples and Hazardous Wastes"*
- U. S. Environmental Protection Agency, Region 2, SOP G-8 *"Laboratory Policy for the Determination of Method Detection Limits (MDLs)."*
- U.S. Environmental Protection Agency, Region 2, SOP G-15 *"Laboratory Definitions and Data Qualifiers"*
- U.S. Environmental Protection Agency, Region 2, SOP C-116 *"Preparation of Aqueous, TCLP Extracts, Soil/Sediment/Sludge, Waste Oil/Organic Solvents, and Biological Tissue Matrices by Block Digestion"*

APPENDIX A

DATA CALCULATIONS

1. Aqueous Samples - undigested

All dilution factors required as a result of dilutions made during analysis are applied at the instrument. Therefore, all of the aqueous sample results generated from the analysis (in ug/L) can be reported directly from the instrument. All results are reported to two significant figures.

2. Aqueous Samples - digested

All dilution factors required as a result of the digestion procedure or dilutions made during analysis are applied at the instrument. All of the aqueous sample results generated from the analysis (in ug/L) can be reported directly from the instrument. All results are reported to two significant figures.

3. Non-Aqueous (Soil/Sediment/Sludge)

All dilution factors required as a result of dilutions made during analysis are applied at the instrument. Therefore, all of the results generated from the analysis (in ug/L) can be used directly from the instrument. These "ug/L" results must then be converted to "mg/Kg" results. The ug/L result is multiplied by the final digestate volume in Liters, usually 0.050 L, and divided by the sample mass in grams, usually 0.50 g (the specific sample volume and mass are recorded in the metals sample preparation log book). Dry weight is normally required for solid matrices, thus, the mg/Kg results must be divided by the decimal version of the percent solids, e.g., 90% is 0.90. The instrument results must be extracted from the experiment - Results page by highlighting the page and transferred to an Excel Spreadsheet for data work-up. The formula is as follows:

$$\text{Conc'n, mg/Kg} = \frac{\text{Inst Rdg, ug/L} \times \text{Sample Prep Vol, mL} \times 100 \%}{\text{Weight, g} \times 1000\text{mL/L} \times \% \text{ Solids}}$$

The data are then tabulated, e. g., in excel format as follows:


Sample No.	Instrument results, ug/L	Final Prepped vol., mL	Sample Wt.,g	% Solids	Sample Conc'n, mg/Kg

The results in ug/L with corresponding sample number are extracted from the instrument at the results page. The prepped volume and sample weights are retrieved from the Sample Preparation Logbook. The Percent Solids are retrieved from the % Solids Logbook. This information is retrieved from various sources must be entered to a Microsoft Excel spread sheet. The resulting concentration in mg/Kg is reported to the LIMS database by manual entry or electronically.

All mg/kg results are reported to two significant figures and, in most cases, are reported down to the standard reporting limit, adjusted for percent solids for dry weight correction.

APPENDIX F

Field and Sample Documentation Examples

 **UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
OFFICIAL SAMPLE SEAL

SAMPLE NO.	SIGNATURE	PRINT NAME AND TITLE (Inspector, Analyst or Technician)	DATE
			SEAL BROKEN BY

EPA FORM 7500-2 (R17-75)

APPENDIX G

**U.S. EPA. Contract Laboratory Program (CLP)
Statement of Work (SOW) for Organic Analysis
Multi-Media, Multi-Concentration (SOM01.2)**

**Office of Emergency and Remedial Response (OERR)
Analytical Operations Center (AOC)**

Washington, DC

FIELD DATA SHEET

SOIL SAMPLING

SITE NAME		DATE		TIME	
SAMPLE LOCATION/DESCRIPTION: _____					

SAMPLE NUMBER:				SAMPLE TYPE	
DEPTHS TAKEN:				SAMPLE ANAL	
BOTTLE SIZE				QC TAKEN	
EQUIPMENT USED: _____					

SAMPLE CHARACTERISTICS: _____					

WEATHER: _____					
XRF USED		YES	NO	CALIBRATION DATE/TIME:	
DEPTH:		INITIAL WEIGHT:		FINAL WEIGHT:	RESULT:
COMMENTS _____					

SAMPLER'S NAME: _____					



Multi-Media, Multi-Concentration, Organic Analytical Service for Superfund (SOM01.2)

Office of Superfund Remediation and Technology Innovation (OSRTI)
Analytical Services Branch (ASB) (5203P)

Quick Reference Fact Sheet

Under the legislative authority granted to the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), EPA develops standardized analytical methods for the measurement of various pollutants in environmental samples from known or suspected hazardous waste sites. Among the pollutants that are of concern to the EPA at such sites are a series of volatile, semivolatile, pesticide, and Aroclor compounds that are analyzed using gas chromatography coupled with mass spectrometry (GC/MS) and gas chromatography with an electron capture detector (GC/ECD). The Analytical Services Branch (ASB) of the Office of Superfund Remediation and Technology Innovation (OSRTI) offers an analytical service that provides data from the analysis of water and soil/sediment samples for organic compounds for use in the Superfund decision-making process. Through a series of standardized procedures and a strict chain-of-custody, the organic analytical service produces data of known and documented quality. This service is available through the Superfund Contract Laboratory Program (CLP).

DESCRIPTION OF SERVICES

This new organic analytical service provides a technical and contractual framework for laboratories to apply EPA/CLP analytical methods for the isolation, detection, and quantitative measurement of 52 volatile, 67 semivolatile, 21 pesticide, and 9 Aroclor target compounds in water and soil/sediment environmental samples. The CLP provides the methods to be used and the specific technical, reporting, and contractual requirements, including Quality Assurance (QA), Quality Control (QC), and Standard Operating Procedures (SOPs), by which EPA evaluates the data. This service uses GC/MS and GC/ECD methods to analyze the target compounds.

Three data delivery turnarounds are available to CLP customers: 7-day, 14-day, and 21-day turnaround after laboratory receipt of the last sample in the set. In addition, there are 48-hour (for trace volatiles and volatiles) and 72-hour (for semivolatiles, pesticides, and Aroclors) preliminary data submission options available. Options under this service include a closed system purge-and-trap method for low-level volatile soil analysis and methanol preservation for medium-level volatile soil analysis. In addition, data users may request modifications to the SOW that may include, but are not limited to, additional compounds, sample matrices other than soil/sediment or water, lower quantitation limits, and other requirements to enhance method performance.

DATA USES

This analytical service provides data which EPA uses for a variety of purposes, such as determining the nature and extent of contamination at a hazardous waste site, assessing priorities for response based on risks to human health and the environment, determining appropriate cleanup actions, and determining when remedial actions are complete. The data may be used in all stages in the investigation of a hazardous waste site including, but not limited to: site inspections; Hazard Ranking System (HRS) scoring; remedial investigations/Feasibility Studies (FSs); remedial design; treatability studies; and removal actions. In addition, this service provides data that will be available for use in Superfund enforcement/litigation activities.

TARGET COMPOUNDS

Table 1 lists the compounds for which this service is applicable and the corresponding quantitation limits. Specific quantitation limits are highly matrix-dependent.

Table 1. Target Compound List (TCL) and Contract Required Quantitation Limits (CRQLs) for SOM01.2*

Quantitation Limits						Quantitation Limits					
	Trace Water by SIM (µg/L)	Trace Water (µg/L)	Low Water (µg/L)	Low Soil (µg/kg)	Med. Soil (µg/kg)		Trace Water by SIM (µg/L)	Trace Water (µg/L)	Low Water (µg/L)	Low Soil (µg/kg)	Med. Soil (µg/kg)
<u>VOLATILES</u>						<u>VOLATILES (CON'T)</u>					
1. Dichlorodifluoromethane		0.50	5.0	5.0	250	40. Ethylbenzene		0.50	5.0	5.0	250
2. Chloromethane		0.50	5.0	5.0	250	41. o-Xylene		0.50	5.0	5.0	250
3. Vinyl Chloride		0.50	5.0	5.0	250	42. m, p-Xylene		0.50	5.0	5.0	250
4. Bromomethane		0.50	5.0	5.0	250	43. Styrene		0.50	5.0	5.0	250
5. Chloroethane		0.50	5.0	5.0	250	44. Bromoform		0.50	5.0	5.0	250
6. Trichlorofluoromethane		0.50	5.0	5.0	250	45. Isopropylbenzene		0.50	5.0	5.0	250
7. 1,1-Dichloroethene		0.50	5.0	5.0	250	46. 1,1,2,2-Tetrachloroethane		0.50	5.0	5.0	250
8. 1,1,2-Trichloro-1,2,2-trifluoroethane		0.50	5.0	5.0	250	47. 1,3-Dichlorobenzene		0.50	5.0	5.0	250
9. Acetone		5.0	10	10	500	48. 1,4-Dichlorobenzene		0.50	5.0	5.0	250
10. Carbon Disulfide		0.50	5.0	5.0	250	49. 1,2-Dichlorobenzene		0.50	5.0	5.0	250
11. Methyl acetate		0.50	5.0	5.0	250	50. 1,2-Dibromo-3-chloropropane	0.050	0.50	5.0	5.0	250
12. Methylene chloride		0.50	5.0	5.0	250	51. 1,2,4-Trichlorobenzene		0.50	5.0	5.0	250
13. trans-1,2-Dichloroethene		0.50	5.0	5.0	250	52. 1,2,3-Trichlorobenzene		0.50	5.0	5.0	250
14. Methyl tert-butyl ether		0.50	5.0	5.0	250						
						<u>SEMIVOLATILES</u>					
15. 1,1-Dichloroethane		0.50	5.0	5.0	250	53. Benzaldehyde		5.0		170	5000
16. cis-1,2-Dichloroethene		0.50	5.0	5.0	250	54. Phenol		5.0		170	5000
17. 2-Butanone		5.0	10	10	500	55. bis-(2-chloroethyl) ether		5.0		170	5000
18. Bromochloromethane		0.50	5.0	5.0	250	56. 2-Chlorophenol		5.0		170	5000
19. Chloroform		0.50	5.0	5.0	250	57. 2-Methylphenol		5.0		170	5000
20. 1,1,1-Trichloroethane		0.50	5.0	5.0	250	58. 2,2'-Oxybis (1-chloropropane)		5.0		170	5000
21. Cyclohexane		0.50	5.0	5.0	250	59. Acetophenone		5.0		170	5000
22. Carbon tetrachloride		0.50	5.0	5.0	250	60. 4-Methylphenol		5.0		170	5000
23. Benzene		0.50	5.0	5.0	250	61. N-Nitroso-di-n propylamine		5.0		170	5000
24. 1,2-Dichloroethane		0.50	5.0	5.0	250	62. Hexachloroethane		5.0		170	5000
25. 1,4-Dioxane			100	100	5000	63. Nitrobenzene		5.0		170	5000
26. Trichloroethene		0.50	5.0	5.0	250	64. Isophorone		5.0		170	5000
27. Methylcyclohexane		0.50	5.0	5.0	250	65. 2-Nitrophenol		5.0		170	5000
28. 1,2-Dichloropropane		0.50	5.0	5.0	250	66. 2,4-Dimethylphenol		5.0		170	5000
29. Bromodichloromethane		0.50	5.0	5.0	250	67. Bis (2-chloroethoxy) methane		5.0		170	5000
30. cis-1,3-Dichloropropene		0.50	5.0	5.0	250	68. 2,4-Dichlorophenol		5.0		170	5000
31. 4-Methyl-2-pentanone		5.0	10	10	500	69. Napthalene	0.10	5.0	3.3	170	5000
32. Toluene		0.50	5.0	5.0	250	70. 4-Chloroaniline		5.0		170	5000
33. trans-1,3-Dichloropropene		0.50	5.0	5.0	250	71. Hexachlorobutadiene		5.0		170	5000
34. 1,1,2-Trichloroethane		0.50	5.0	5.0	250	72. Caprolactam		5.0		170	5000
35. Tetrachloroethene		0.50	5.0	5.0	250	73. 4-Chloro-3-methylphenol		5.0		170	5000
36. 2-Hexanone		5.0	10	10	500	74. 2-Methylnapthalene	0.10	5.0	3.3	170	5000
37. Dibromochloromethane		0.50	5.0	5.0	250	75. Hexachlorocyclo-pentadiene		5.0		170	5000
38. 1,2-Dibromoethane	0.050	0.50	5.0	5.0	250	76. 2,4,6-Trichlorophenol		5.0		170	5000
39. Chlorobenzene		0.50	5.0	5.0	250	77. 2,4,5-Trichlorophenol		5.0		170	5000

For volatiles, quantitation limits for medium soils are approximately 50 times the quantitation limits for low soils. For semivolatile medium soils, quantitation limits are approximately 30 times the quantitation limits for low soils.

Table 1. Target Compound List (TCL) and Contract Required Quantitation Limits (CRQLs) for SOM01.2* (Con't)

Quantitation Limits						Quantitation Limits					
	Low Water by SIM (µg/L)	Low Water (µg/L)	Low Soil by SIM (µg/kg)	Low Soil (µg/kg)	Med. Soil (µg/kg)		Low Water by SIM (µg/L)	Low Water (µg/L)	Low Soil by SIM (µg/kg)	Low Soil (µg/kg)	Med. Soil (µg/kg)
<u>SEMIVOLATILES (CON'T)</u>						<u>SEMIVOLATILES (CON'T)</u>					
78. 1,1'-Biphenyl		5.0		170	5000	115. Benzo (a) pyrene	0.10	5.0	3.3	170	5000
79. 2-Chloronaphthalene		5.0		170	5000	116. Indeno (1,2,3-cd)-pyrene	0.10	5.0	3.3	170	5000
80. 2-Nitroaniline		10		330	10000	117. Dibenzo (a,h)-anthracene	0.10	5.0	3.3	170	5000
81. Dimethylphthalate		5.0		170	5000	118. Benzo (g,h,i) perylene	0.10	5.0	3.3	170	5000
82. 2,6-Dinitrotoluene		5.0		170	5000	119. 2,3,4,6-Tetrachlorophenol		5.0		170	5000
83. Acenaphthylene	0.10	5.0	3.3	170	5000	<u>PESTICIDES</u>		Water (µg/L)		Soil (µg/kg)	
84. 3-Nitroaniline		10		330	10000	120. alpha-BHC		0.050		1.7	
85. Acenaphthene	0.10	5.0	3.3	170	5000	121. beta-BHC		0.050		1.7	
86. 2,4-Dinitrophenol		10		330	10000	122. delta-BHC		0.050		1.7	
87. 4-Nitrophenol		10		330	10000	123. gamma-BHC (Lindane)		0.050		1.7	
88. Dibenzofuran		5.0		170	5000	124. Heptachlor		0.050		1.7	
89. 2,4-Dinitrotoluene		5.0		170	5000	125. Aldrin		0.050		1.7	
90. Diethylphthalate		5.0		170	5000	126. Heptachlor epoxide		0.050		1.7	
91. Fluorene	0.10	5.0	3.3	170	5000	127. Endosulfan I		0.050		1.7	
92. 4-Chlorophenyl-phenyl ether		5.0		170	5000	128. Dieldrin		0.10		3.3	
93. 4-Nitroaniline		10		330	10000	129. 4,4'-DDE		0.10		3.3	
94. 4,6-Dinitro-2-methylphenol		10		330	10000	130. Endrin		0.10		3.3	
95. N-Nitrosodiphenylamine		5.0		170	5000	131. Endosulfan II		0.10		3.3	
96. 1,2,4,5-Tetrachlorobenzene		5.0		170	5000	132. 4,4'-DDD		0.10		3.3	
97. 4-Bromophenyl-phenylether		5.0		170	5000	133. Endosulfan sulfate		0.10		3.3	
98. Hexachlorobenzene		5.0		170	5000	134. 4,4'-DDT		0.10		3.3	
99. Atrazine		5.0		170	5000	135. Methoxychlor		0.50		17	
100. Pentachlorophenol	0.20	10	6.7	330	10000	136. Endrin ketone		0.10		3.3	
101. Phenanthrene	0.10	5.0	3.3	170	5000	137. Endrin aldehyde		0.10		3.3	
102. Anthracene	0.10	5.0	3.3	170	5000	138. alpha-Chlordane		0.050		1.7	
103. Carbazole		5.0		170	5000	139. gamma-Chlordane		0.050		1.7	
104. Di-n-butylphthalate		5.0		170	5000	140. Toxaphene		5.0		170	
105. Fluoranthene	0.10	5.0	3.3	170	5000	<u>AROCLORS</u>		Water (µg/L)		Soil (µg/kg)	
106. Pyrene	0.10	5.0	3.3	170	5000	141. Aroclor-1016		1.0		33	
107. Butylbenzylphthalate		5.0		170	5000	142. Aroclor-1221		1.0		33	
108. 3,3'-Dichlorobenzidine		5.0		170	5000	143. Aroclor-1232		1.0		33	
109. Benzo (a) anthracene	0.10	5.0	3.3	170	5000	144. Aroclor-1242		1.0		33	
110. Chrysene	0.10	5.0	3.3	170	5000	145. Aroclor-1248		1.0		33	
111. Bis (2-ethylhexyl) phthalate		5.0		170	5000	146. Aroclor-1254		1.0		33	
112. Di-n-octylphthalate		5.0		170	5000	147. Aroclor-1260		1.0		33	
113. Benzo (b) fluoroanthene	0.10	5.0	3.3	170	5000	148. Aroclor-1262		1.0		33	
114. Benzo (k) fluoroanthene	0.10	5.0	3.3	170	5000	149. Aroclor-1268		1.0		33	

* For volatiles, quantitation limits for medium soils are approximately 50 times the quantitation limits for low soils. For semivolatile medium soils, quantitation limits are approximately 30 times the quantitation limits for low soils.

The TCL for this service was originally derived from the EPA Priority Pollutant List of 129 compounds. In the years since the inception of the CLP, compounds have been added to and removed from the TCL, based on advances in analytical methods, evaluation of method performance data, and the needs of the Superfund program. The SOM analytical service combines the previous OLM and OLC services into one method. For example, drinking water and ground water type samples may be analyzed using the Trace Volatiles method in SOM.

METHODS AND INSTRUMENTATION

For trace volatile water samples, 25 mL of water sample is added to a purge-and-trap device and purged with an inert gas at room temperature. For low/medium volatile water samples, 5 mL of water sample is added to a purge-and-trap device and purged with an inert gas at room temperature. Higher purge temperatures may be used for both trace and low/medium volatile analyses if all technical acceptance criteria is met for all standards, samples, and blanks. For low-level volatile soil samples, organic compounds are generally determined by analyzing approximately 5 g of sample in a closed-system purge-and-trap device at 40°C. For a medium-level soil sample, a soil sample of 5 g is collected, preserved, and/or extracted with methanol and an aliquot of methanol extract is added to 5 mL reagent water and purged at room temperature. For water and soil samples, the volatiles purged from the sample are trapped on a solid sorbent. The purged volatiles are subsequently desorbed by rapidly heating and backflushing with helium, and then introduced into a GC/MS system.

For semivolatile, pesticide, and Aroclor water samples, a 1 L aliquot of sample is extracted with methylene chloride using a continuous liquid-liquid extractor or separatory funnel (for pesticides and Aroclors only). For low-level semivolatile, pesticide, and Aroclor soil samples, a 30 g soil/sediment sample is extracted with methylene chloride/acetone using sonication, automated Soxhlet/Dean-Stark (SDS) extraction, or pressurized fluid extraction techniques. For medium-level semivolatile soil samples, a 1g aliquot is extracted with methylene chloride using the techniques mentioned above for low-level soil samples. For both water and soil samples, the extract is concentrated, subjected to fraction-specific cleanup procedures, and analyzed by GC/MS for semivolatiles or GC/ECD for pesticides and Aroclors. Table 2 summarizes the methods and instruments used in this analytical service.

DATA DELIVERABLES

Data deliverables for this service include hardcopy data reporting forms and supporting raw data. In addition to the hardcopy deliverable, contract laboratories must also submit the same data electronically. The laboratory must submit data to EPA within 7, 14, or 21-days after laboratory receipt of the last sample in set [or

preliminary data within 48 hours (for trace volatiles and volatiles) or 72 hours (for semivolatiles, pesticides, and Aroclors)] after laboratory receipt of each sample. EPA then processes the data through an automated Data Assessment Tool (DAT). DAT provides EPA Regions with PC-compatible reports, spreadsheets, and electronic files within 24-48 hours from the receipt of the data for use in data validation. This automated tool also facilitates the transfer of analytical data into Regional databases. In addition to the Regional electronic reports, the CLP laboratories are provided with a data assessment report that documents the instances of noncompliance. The laboratory has 6 business days to reconcile defective data and resubmit the data to EPA. EPA then reviews the data for noncompliance and sends a final data assessment report to the CLP laboratory and the Region.

QUALITY ASSURANCE (QA)

The QA process consists of management review and oversight at the planning, implementation, and completion stages of the environmental data collection activity. This process ensures that the data provided are of known and documented quality.

During the implementation of the data collection effort, QA activities ensure that the Quality Control (QC) system is functioning effectively and that the deficiencies uncovered by the QC system are corrected. After environmental data are collected, QA activities focus on assessing the quality of data to determine its suitability to support enforcement or remedial decisions.

Each contract laboratory prepares a Quality Assurance Plan (QAP) with the objective of providing sound analytical chemical measurements. The QAP must specify the policies, organization, objectives, and functional guidelines, as well as the QA and QC activities designed to achieve the data quality requirements in the contract.

QUALITY CONTROL (QC)

The QC process includes those activities required during analytical data collection to produce data of known and documented quality. The analytical data acquired from QC procedures are used to estimate and evaluate the analytical results and to determine the necessity for, or the effect of, corrective action procedures. The QC procedures required for this analytical service are provided in Table 3.

Table 2. Methods and Instruments

Fraction	Water	Soil
Trace Volatiles	Purge-and-trap followed by GC/MS analysis	N/A
Volatiles	Purge-and-trap followed by GC/MS analysis	Purge-and-trap or closed-system purge-and-trap followed by GC/MS analysis
Semivolatiles	Continuous liquid-liquid extraction (CLLE) followed by GC/MS analysis	Sonication, automated SDS extraction, or pressurized fluid extraction followed by GC/MS analysis
Pesticides	CLLE or separatory funnel extraction followed by dual column GC/ECD analysis	Sonication, automated SDS extraction or pressurized fluid extraction followed by dual column GC/ECD analysis
Aroclors	CLLE or separatory funnel extraction followed by dual column GC/ECD analysis	Sonication, automated SDS extraction or pressurized fluid extraction followed by dual column GC/ECD analysis

Table 3. Quality Control (QC)

QC Operation	Frequency
Deuterated Monitoring Compounds (DMCs) (trace volatiles, volatiles, and semivolatiles)	Added to each sample, standard, and blank
Surrogates (pesticides and Aroclors)	Added to each sample, standard, and blank
Method Blanks (trace volatiles and volatiles)	Analyzed at least every 12 hours for each matrix and level
Method Blanks (semivolatiles, pesticides, and Aroclors)	Prepared with each group of 20 samples or less of same matrix and level, or each time samples are extracted by the same procedure
Instrument Blank (trace volatiles and volatiles)	Analyzed after a sample which contains compounds at concentrations greater than the calibration range
Instrument Blank (pesticides and Aroclors)	Every 12 hours on each GC column used for analysis
Storage Blanks (trace volatiles and volatiles)	Prepared and stored with each set of samples
GC/MS Mass Calibration and Ion Abundance Patterns (trace volatiles, volatiles, and semivolatiles)	Every 12 hours for each instrument used for analysis
GC Resolution Check (pesticides)	Prior to initial calibration, on each instrument used for analysis
Initial Calibration	Upon initial set up of each instrument, and each time continuing calibration fails to meet the acceptance criteria
Continuing Calibration	Every 12 hours for each instrument used for analysis
Internal Standards (trace volatiles, volatiles, and semivolatiles)	Added to each sample, standard, and blank
Matrix Spike and Matrix Spike Duplicate (MS/MSD)	Once every 20 or fewer samples of same fraction, matrix, and level in a Sample Delivery Group (SDG)
Laboratory Control Samples (LCSs) (pesticides and Aroclors)	Once every 20 or fewer samples of same fraction, matrix, and level in an SDG
Method Detection Limit (MDL)	Determined annually, per matrix and level

PERFORMANCE MONITORING ACTIVITIES

Laboratory performance monitoring activities are provided primarily by ASB and the Regions to ensure that contract laboratories are producing data of the appropriate quality. EPA performs on-site laboratory audits, data package audits, GC/MS and/or GC/ECD tape audits, and evaluates laboratory performance through the use of blind Performance Evaluation (PE) samples.

CONTACTING EPA

For more information, or for suggestions to improve this analytical service, please contact:

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ANNEX B
EPA REGION II LABORATORY
ANALYTICAL SAMPLE DATA SHEETS

Case Narrative:

Jewett White Lead Company #08120050

The National Environmental Laboratory Accreditation Conference (NELAC) is a voluntary environmental laboratory accreditation association of State and Federal agencies. NELAC established and promoted a national accreditation program that provides a uniform set of standards for the generation of environmental data that are of known and defensible quality. The EPA Region 2 Laboratory is NELAC accredited. The Laboratory tests that are accredited have met all the requirements established under the NELAC Standards.

Comment(s):

None.

Data Qualifier(s):

- U- The analyte was not detected at or above the Reporting Limit.
- J- The identification of the analyte is acceptable; the reported value is an estimate.
- K- The identification of the analyte is acceptable; the reported value may be biased high.
- L- The identification of the analyte is acceptable; the reported value may be biased low.
- NJ- There is presumptive evidence that the analyte is present; the analyte is reported as a tentative identification. The reported value is an estimate.

Reporting Limit(s):


The Laboratory was able to achieve the Contract Required Quantitation Limits (CRQLs), where applicable, for each analyte requested.

Method(s):

All methods that are NELAC accredited in the Laboratory are noted with "NELAC" at the end of the method reference.

- PCBs Analysis, EPA SOP C-91 (GC/ECD Method)

Approval: _____



Date: _____

2-3-09

ANNEX C
EPA REGION II MOBILE LABORATORY
ANALYTICAL SAMPLE RESULTS DATA SHEETS

U.S. EPA

COVER PAGE

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: MODSW846 6020ALab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: RB-01SOW No.: N/AEPA Sample No.RB-01
RB-01(D)
RB-01(S)
RB-01(L)
RB-02Lab Sample IDA-1-1
RB-01(D)
RB-01(S)
RB-01(L)
RB-02

	ICP-AES	ICP-MS
Were ICP-AES and ICP-MS interelement corrections applied? (Yes/No)	_____	<u>No</u>
Were ICP-AES and ICP-MS background corrections applied? (Yes/No)	_____	<u>No</u>
If yes, were raw data generated before application of background corrections? (Yes/No)	_____	<u>No</u>

Comments:

(D) = laboratory matrix duplicate sample, (S) = laboratory matrix spike
sample (L) = Serial Dilution sample

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

RB-01

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett/Key QC NRAS No.: _____ SDG No.: RB-01

Matrix: (soil/water) Water

Lab Sample ID: RB-01

Level: (low/med) Low

Date Received: 12/17/08

% Solids: N/A

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): $\mu\text{g/L}$

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	0.52	U		MS
7440-36-0	Antimony	3.08	B		MS
7440-38-2	Arsenic	1.92	B		MS
7440-39-3	Barium	0.80	B		MS
7440-41-7	Beryllium	0.30	U		MS
7440-43-9	Cadmium	0.09	U		MS
7440-70-2	Calcium	1.65	U		MS
7440-47-3	Chromium	14.10			MS
7440-48-4	Cobalt	0.19	B		MS
7440-50-8	Copper	39.50			MS
7439-89-6	Iron	2670.00			MS
7439-92-1	Lead	25.20			MS
7439-95-4	Magnesium	44.40	B		MS
7439-96-5	Manganese	14.70	B	J	MS
7439-97-6	Mercury	0.05	U		MS
7440-02-0	Nickel	4.01	B		MS
7440-09-7	Potassium	452.00	B		MS
7782-49-2	Selenium	6.85	B		MS
7440-22-4	Silver	0.01	U	J	MS
7440-23-5	Sodium	2110.00	B		MS
7440-28-0	Thallium	1.40	B	J	MS
7440-62-2	Vanadium	1.52	B		MS
7440-66-6	Zinc	0.16	U	J	MS

Color Before: Clear

Clarity Before: Clear

Texture: None

Color After: Clear

Clarity After: Clear

Artifacts: None

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

RB-02

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett/Key QC NRAS No.: _____ SDG No.: RB-01

Matrix: (soil/water) Water

Lab Sample ID: RB-02

Level: (low/med) Low

Date Received: 12/17/08

% Solids: N/A

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): $\mu\text{g/L}$

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	0.52	U		MS
7440-36-0	Antimony	2.49	B		MS
7440-38-2	Arsenic	1.53	B		MS
7440-39-3	Barium	0.03	U		MS
7440-41-7	Beryllium	0.30	U		MS
7440-43-9	Cadmium	0.09	U		MS
7440-70-2	Calcium	157.00	B		MS
7440-47-3	Chromium	24.10			MS
7440-48-4	Cobalt	0.02	U		MS
7440-50-8	Copper	46.10			MS
7439-89-6	Iron	41.80	B		MS
7439-92-1	Lead	0.02	U		MS
7439-95-4	Magnesium	16.01	B		MS
7439-96-5	Manganese	0.99	B	J	MS
7439-97-6	Mercury	0.05	U		MS
7440-02-0	Nickel	6.35	B		MS
7440-09-7	Potassium	233.00	B		MS
7782-49-2	Selenium	6.64	B		MS
7440-22-4	Silver	0.01	U	J	MS
7440-23-5	Sodium	1780.00	B		MS
7440-28-0	Thallium	0.69	B	J	MS
7440-62-2	Vanadium	1.11	B		MS
7440-66-6	Zinc	0.16	U	J	MS

Color Before: Clear

Clarity Before: Clear

Texture: None

Color After: Clear

Clarity After: Clear

Artifacts: None

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

U.S. EPA
2A-IN
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett/Key1 NRAS No.: N/A SDG No.: RB-01

Initial Calibration Verification Source: VHG

Continuing Calibration Verification Source: VHG

Concentration Units: ug/L

Analyte	Initial Calibration Verification			Continuing Calibration Verification					M.
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	
Aluminum	200	179	89.5	300	289	96.3			MS
Antimony	200	188	94.0	300	313	104.0			MS
Arsenic	200	191	95.5	300	297	99.0			MS
Barium	200	193	96.5	300	304	101.0			MS
Beryllium	200	200	100.0	300	309	103.0			MS
Cadmium	200	195	97.5	300	303	101.0			MS
Calcium	40000	39500	98.8	60000	64100	107.0			MS
Chromium	200	184	92.0	300	286	95.3			MS
Cobalt	200	190	95.0	300					MS
Copper	200	196	98.0	300					MS
Iron	40000	40200	101.0	60000					MS
Lead	200	214	107.0	300					MS
Magnesium	40000	39900	99.8	60000					MS
Manganese	200	226	113.0	300					MS
Mercury	0.800	791	98.9	1.20					MS
Nickel	200	196	98.0	300					MS
Potassium	40000	39800	99.5	60000					MS
Selenium	200	201	100.0	300					MS
Silver	200	179	90.0	300					MS
Sodium	40000	39600	99.0	60000					MS
Thallium	200	222	111.0	300					MS
Vanadium	200	194	97.0	300					MS
Zinc	200	178	89.0	300					MS

(1) Control Limits: Mercury 80-120; Other Metals 90-110

U.S. EPA
2A-IN
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett/Key1 NRAS No.: N/A SDG No.: RB-01

Initial Calibration Verification Source: VHG

Continuing Calibration Verification Source: VHG

Concentration Units: ug/L

Analyte	Initial Calibration Verification			Continuing Calibration Verification					M
	True	Found	%R(1)	True	Found	%R(1)	Found	%R(1)	
Aluminum	200	179	89.5	300	289	96.3			MS
Antimony	200	188	94.0	300	313	104.0			MS
Arsenic	200	191	95.5	300	297	99.0			MS
Barium	200	193	96.5	300	304	101.0			MS
Beryllium	200	200	100.0	300	309	103.0			MS
Cadmium	200	195	97.5	300	303	101.0			MS
Calcium	40000	39500	98.8	60000	64100	107.0			MS
Chromium	200	184	92.0	300	286	95.3			MS
Cobalt	200	190	95.0	300					MS
Copper	200	196	98.0	300					MS
Iron	40000	40200	101.0	60000					MS
Lead	200	214	107.0	300					MS
Magnesium	40000	39900	99.8	60000					MS
Manganese	200	226	113.0	300					MS
Mercury	0.800	791	98.9	1.20					MS
Nickel	200	196	98.0	300					MS
Potassium	40000	39800	99.5	60000					MS
Selenium	200	201	100.0	300					MS
Silver	200	179	90.0	300					MS
Sodium	40000	39600	99.0	60000					MS
Thallium	200	222	111.0	300					MS
Vanadium	200	194	97.0	300					MS
Zinc	200	178	89.0	300					MS

(1) Control Limits: Mercury 80-120; Other Metals 90-110

J - Estimated concentration due to data validation criteria.

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

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Case# <u>Jewett1</u>	Site <u>Jewett Lead</u>	Matrix Soil: <u>00</u>
SDG# <u>RB-01</u>	Lab <u>U.S. EPA Region 2 Mobile Lab</u>	Water: <u>02</u>
Contractor <u>Not Applicable</u>	Reviewer <u>Robert Finke</u>	Other: <u>00</u>

A.2.1 Validation Flags- The following flags have been applied in red by the data validator
Which must be considered by the data user.

- J - This flag indicates that a result is qualified as estimated.
- UJ - This flag indicates that the analyte was analyzed but not detected
And is to be considered as estimated because it may be inaccurate
or imprecise.
- R - This flag indicates that the sample result is to be considered
unusable due to significant error and must not be used by the data
user.

Fully Usable Data - Results which carry a "J" or "UJ" are considered to be fully usable.

Contractual Qualifiers - The legend of the contractual qualifiers applied by the laboratory
On the Form I's are found on page B-20 of SOW ILM04.0.

A.2.2 The data assessment is given below and on the attached data sheets

This SDG (RB-01) consists of two water samples collected between December 17-18, 2008
from the Jewett Lead Superfund site on Staten Island, NY. The samples were prepared January
2, 2009 and analyzed on February 6, 2008 by the U.S. EPA Region 2 Mobile Analytical
Laboratory for the 22 routine Target Analyte List (TAL) metals with full Contract Laboratory
Program (CLP) Quality Control (QC). This analysis was conducted according to SOP MAL-
3.07A which is based upon U.S. EPA CLP SOW ILM04.0, SW-846 Method 6010A, and the U.S.
EPA Region 2 DESA Laboratory protocol. Upon completion of this analysis and compiling the
results, a formal validation was performed to assure the data contained in this analytical report
are of appropriate quality. This being performed as part of the requirements of the Quality
Assurance (QA) program put forth for the U.S. EPA Region 2 Mobile Analytical Laboratory to
ensure its proper operation. This review and evaluation was carried out according to the U.S.
EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

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And U.S. EPA Region 2 Data Validation SOP *Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW. 3/90, Rev. XI.* It applies to a systematic approach for examining analytical results to identify and assess the indication of bias to render an overall determination of data usability. In doing so, the data user is assured as to how well a given set of analytical results will conform to the established environmental monitoring performance criteria defined for their project. In accordance, the following qualifications are applied to this data set which must be considered when utilizing these results to make sound environmental decisions.

1. Calibration

The results of several Initial Calibration Verification (ICV) determinations yielded recoveries which were not within the specified control limits of 90 - 110%R. This requires that the associated results be qualified as estimated "J" in the affected environmental samples, resulting in the following required action(s.)

Element	%R	Qualification	Sample(s) Qualified
Manganese	113	J	RB-01, RB-02
Thallium	111	J	RB-01, RB-02
Zinc	89	J	RB-01, RB-02

The results of a Continuing Calibration Verification (CCV) determination yielded a recovery which was not within the specified control limits of 90 - 110%R. This requires that the associated results be qualified as estimated "J" in the affected environmental samples, resulting in the following required action(s.)

Element	%R	Qualification	Sample(s) Qualified
Manganese	119	J	Previously Qualified for ICV

2. Laboratory Control Sample

The Laboratory Control Sample (LCS) "found" value for silver was greater than the upper acceptable range and has therefore been qualified estimated "J" in samples RB-01 and RB-02.

U.S. EPA
COVER PAGE

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: MODSW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

SOW No.: N/A

<u>EPA Sample No.</u>	<u>Lab Sample ID</u>
A-1-0	A-1-0
A-2-0	A-2-0
A-3-0	A-3-0
A-4-0	A-4-0
A-5-0	A-5-0
A-5-0(D)	A-5-0(D)
A-5-0(S)	A-5-0(S)
A-5-0(L)	A-5-0(L)
BG-1-0	BG-1-0
BG-1-1	BG-1-1
BG-2-0	BG-2-0
BG-2-1	BG-2-1
C-3-2	C-3-2
D-2-2	D-2-2
D-2-3	D-2-3
E-1-1	E-1-1
E-1-2	E-1-2
E-1-3	E-1-3
E-2-1	E-2-1
E-2-2	E-2-2
E-2-3	E-2-3
O-1	O-1
O-2	O-2

		ICP-AES	ICP-MS
Were ICP-AES and ICP-MS interelement corrections applied?	(Yes/No)	_____	<u>No</u>

Were ICP-AES and ICP-MS background corrections applied?	(Yes/No)	_____	<u>No</u>
---------------------------------------------------------	----------	-------	-----------

If yes, were raw data generated before application of background corrections?	(Yes/No)	_____	<u>No</u>
-------------------------------------------------------------------------------	----------	-------	-----------

Comments:

(D) = Laboratory Matrix Duplicate Sample, (S) = Laboratory Matrix Spike sample (L) = Serial Dilution Sample

U.S. EPA
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EPA SAMPLE NO.

A-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: A-1-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 66.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7000.00			MS
7440-36-0	Antimony	0.09	B	J	MS
7440-38-2	Arsenic	3.74			MS
7440-39-3	Barium	81.00			MS
7440-41-7	Beryllium	0.53			MS
7440-43-9	Cadmium	0.29		J	MS
7440-70-2	Calcium	43200.00			MS
7440-47-3	Chromium	41.5		J	MS
7440-48-4	Cobalt	9.75		J	MS
7440-50-8	Copper	33.60			MS
7439-89-6	Iron	15300.00		J	MS
7439-92-1	Lead	1008.00			MS
7439-95-4	Magnesium	16400.00			MS
7439-96-5	Manganese	323.00			MS
7439-97-6	Mercury	0.12		J	MS
7440-02-0	Nickel	130.00		J	MS
7440-09-7	Potassium	1301.00			MS
7782-49-2	Selenium	0.28	B	J	MS
7440-22-4	Silver	0.12	B	J	MS
7440-23-5	Sodium	432.00	B	J	MS
7440-28-0	Thallium	0.21	B	J	MS
7440-62-2	Vanadium	22.40			MS
7440-66-6	Zinc	96.90			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

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EPA SAMPLE NO.

A-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: A-2-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 90.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10100.00			MS
7440-36-0	Antimony	1.85	B	J	MS
7440-38-2	Arsenic	7.15			MS
7440-39-3	Barium	591.00			MS
7440-41-7	Beryllium	3.13			MS
7440-43-9	Cadmium	0.90		J	MS
7440-70-2	Calcium	80200.00			MS
7440-47-3	Chromium	12.90		J	MS
7440-48-4	Cobalt	4.96		J	MS
7440-50-8	Copper	86.50			MS
7439-89-6	Iron	11700.00		J	MS
7439-92-1	Lead	37100.00			MS
7439-95-4	Magnesium	16040.00			MS
7439-96-5	Manganese	11900.00			MS
7439-97-6	Mercury	0.39		J	MS
7440-02-0	Nickel	110.00		J	MS
7440-09-7	Potassium	996.00			MS
7782-49-2	Selenium	0.95	B	J	MS
7440-22-4	Silver	0.85	B	J	MS
7440-23-5	Sodium	583.00		J	MS
7440-28-0	Thallium	0.29	B	J	MS
7440-62-2	Vanadium	14.30			MS
7440-66-6	Zinc	122.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

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EPA SAMPLE NO.

A-3-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: A-3-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 89.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6460.00			MS
7440-36-0	Antimony	0.12	B	J	MS
7440-38-2	Arsenic	3.10			MS
7440-39-3	Barium	81.90			MS
7440-41-7	Beryllium	0.90	B		MS
7440-43-9	Cadmium	0.30	B	J	MS
7440-70-2	Calcium	8660.00			MS
7440-47-3	Chromium	47.60		J	MS
7440-48-4	Cobalt	11.80		J	MS
7440-50-8	Copper	53.00			MS
7439-89-6	Iron	14900.00		J	MS
7439-92-1	Lead	734.00			MS
7439-95-4	Magnesium	9090.00			MS
7439-96-5	Manganese	342.00			MS
7439-97-6	Mercury	0.09		J	MS
7440-02-0	Nickel	143.00		J	MS
7440-09-7	Potassium	1060.00			MS
7782-49-2	Selenium	0.11	B	J	MS
7440-22-4	Silver	0.12	B	J	MS
7440-23-5	Sodium	356.00	B	J	MS
7440-28-0	Thallium	0.20	B	J	MS
7440-62-2	Vanadium	17.50			MS
7440-66-6	Zinc	143.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

A-4-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: A-4-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 89.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6900.00			MS
7440-36-0	Antimony	0.03	B	J	MS
7440-38-2	Arsenic	2.95			MS
7440-39-3	Barium	81.20			MS
7440-41-7	Beryllium	0.67			MS
7440-43-9	Cadmium	0.25	B	J	MS
7440-70-2	Calcium	9600.00			MS
7440-47-3	Chromium	72.20		J	MS
7440-48-4	Cobalt	29.20		J	MS
7440-50-8	Copper	35.10			MS
7439-89-6	Iron	20800.00		J	MS
7439-92-1	Lead	257.00			MS
7439-95-4	Magnesium	13100.00			MS
7439-96-5	Manganese	520.00			MS
7439-97-6	Mercury	0.17		J	MS
7440-02-0	Nickel	620.00		J	MS
7440-09-7	Potassium	1470.00			MS
7782-49-2	Selenium	0.09	B	J	MS
7440-22-4	Silver	0.09	B	J	MS
7440-23-5	Sodium	796.00		J	MS
7440-28-0	Thallium	0.34	B	J	MS
7440-62-2	Vanadium	15.80			MS
7440-66-6	Zinc	82.20			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

A-5-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: A-5-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 80.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7804.00			MS
7440-36-0	Antimony	0.54	B	J	MS
7440-38-2	Arsenic	9.59			MS
7440-39-3	Barium	184.00			MS
7440-41-7	Beryllium	0.75			MS
7440-43-9	Cadmium	1.11		J	MS
7440-70-2	Calcium	44700.00			MS
7440-47-3	Chromium	86.60		J	MS
7440-48-4	Cobalt	15.60		J	MS
7440-50-8	Copper	72.40			MS
7439-89-6	Iron	17600.00		J	MS
7439-92-1	Lead	8005.00			MS
7439-95-4	Magnesium	11200.00			MS
7439-96-5	Manganese	443.00			MS
7439-97-6	Mercury	0.59		J	MS
7440-02-0	Nickel	248.00		J	MS
7440-09-7	Potassium	1220.00			MS
7782-49-2	Selenium	0.37	B	J	MS
7440-22-4	Silver	0.44	B	J	MS
7440-23-5	Sodium	528.00		J	MS
7440-28-0	Thallium	0.54	B	J	MS
7440-62-2	Vanadium	23.30			MS
7440-66-6	Zinc	335.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

BG-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: BG-1-0

Level: (low/med) Low Date Received: 12/18/08

% Solids: 64.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1510.00			MS
7440-36-0	Antimony	0.09	B	J	MS
7440-38-2	Arsenic	1.44	B		MS
7440-39-3	Barium	16.90	B		MS
7440-41-7	Beryllium	0.11	B		MS
7440-43-9	Cadmium	0.08	B	J	MS
7440-70-2	Calcium	1390.00			MS
7440-47-3	Chromium	4.53		J	MS
7440-48-4	Cobalt	1.22	B	J	MS
7440-50-8	Copper	11.30			MS
7439-89-6	Iron	2230.00		J	MS
7439-92-1	Lead	32.90			MS
7439-95-4	Magnesium	573.00	B		MS
7439-96-5	Manganese	62.90			MS
7439-97-6	Mercury	0.05		J	MS
7440-02-0	Nickel	8.89		J	MS
7440-09-7	Potassium	181.00	B		MS
7782-49-2	Selenium	0.10	B	J	MS
7440-22-4	Silver	0.05	B	J	MS
7440-23-5	Sodium	74.20	B	J	MS
7440-28-0	Thallium	0.03	B	J	MS
7440-62-2	Vanadium	4.01	B		MS
7440-66-6	Zinc	21.50			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

U.S. EPA
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EPA SAMPLE NO.

BG-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: BG-1-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 64.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12000.00			MS
7440-36-0	Antimony	0.72	B	J	MS
7440-38-2	Arsenic	10.80			MS
7440-39-3	Barium	134.00			MS
7440-41-7	Beryllium	0.89			MS
7440-43-9	Cadmium	0.71		J	MS
7440-70-2	Calcium	8120.00			MS
7440-47-3	Chromium	33.00		J	MS
7440-48-4	Cobalt	9.97		J	MS
7440-50-8	Copper	88.40			MS
7439-89-6	Iron	17700.00		J	MS
7439-92-1	Lead	305.00			MS
7439-95-4	Magnesium	3720.00			MS
7439-96-5	Manganese	454.00			MS
7439-97-6	Mercury	0.39		J	MS
7440-02-0	Nickel	81.70		J	MS
7440-09-7	Potassium	1790.00			MS
7782-49-2	Selenium	0.81	B	J	MS
7440-22-4	Silver	0.43	B	J	MS
7440-23-5	Sodium	462.00		J	MS
7440-28-0	Thallium	0.21	B	J	MS
7440-62-2	Vanadium	31.70			MS
7440-66-6	Zinc	202.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

BG-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: BG-2-0

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 61.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10700.00			MS
7440-36-0	Antimony	0.81	B	J	MS
7440-38-2	Arsenic	52.40			MS
7440-39-3	Barium	181.00			MS
7440-41-7	Beryllium	0.68			MS
7440-43-9	Cadmium	1.26		J	MS
7440-70-2	Calcium	17300.00			MS
7440-47-3	Chromium	33.00		J	MS
7440-48-4	Cobalt	12.30		J	MS
7440-50-8	Copper	97.20			MS
7439-89-6	Iron	20300.00		J	MS
7439-92-1	Lead	406.00			MS
7439-95-4	Magnesium	5029.00			MS
7439-96-5	Manganese	579.00			MS
7439-97-6	Mercury	0.42		J	MS
7440-02-0	Nickel	37.60		J	MS
7440-09-7	Potassium	1350.00			MS
7782-49-2	Selenium	0.45	B	J	MS
7440-22-4	Silver	0.55	B	J	MS
7440-23-5	Sodium	512.00		J	MS
7440-28-0	Thallium	0.19	B	J	MS
7440-62-2	Vanadium	44.70			MS
7440-66-6	Zinc	237.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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EPA SAMPLE NO.

BG-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: BG-2-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 61.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10100.00			MS
7440-36-0	Antimony	0.56	B	J	MS
7440-38-2	Arsenic	81.50			MS
7440-39-3	Barium	108.00			MS
7440-41-7	Beryllium	0.70			MS
7440-43-9	Cadmium	0.87		J	MS
7440-70-2	Calcium	6590.00			MS
7440-47-3	Chromium	42.00		J	MS
7440-48-4	Cobalt	7.73		J	MS
7440-50-8	Copper	59.10			MS
7439-89-6	Iron	16600.00		J	MS
7439-92-1	Lead	516.00			MS
7439-95-4	Magnesium	3020.00			MS
7439-96-5	Manganese	389.00			MS
7439-97-6	Mercury	0.36		J	MS
7440-02-0	Nickel	39.00		J	MS
7440-09-7	Potassium	726.00			MS
7782-49-2	Selenium	0.80	B	J	MS
7440-22-4	Silver	0.78	B	J	MS
7440-23-5	Sodium	259.00	B	J	MS
7440-28-0	Thallium	0.20	B	J	MS
7440-62-2	Vanadium	48.40			MS
7440-66-6	Zinc	232.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-3-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: C-3-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 49.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10800.00		J	MS
7440-36-0	Antimony	1.65	B	J	MS
7440-38-2	Arsenic	4.96		J	MS
7440-39-3	Barium	1380.00		J	MS
7440-41-7	Beryllium	0.95		J	MS
7440-43-9	Cadmium	2.58		J	MS
7440-70-2	Calcium	91600.00		J	MS
7440-47-3	Chromium	184.00		J	MS
7440-48-4	Cobalt	127.00		J	MS
7440-50-8	Copper	360.00		J	MS
7439-89-6	Iron	61600.00		J	MS
7439-92-1	Lead	118000.00		J	MS
7439-95-4	Magnesium	76600.00		J	MS
7439-96-5	Manganese	5720.00		J	MS
7439-97-6	Mercury	2.00		J	MS
7440-02-0	Nickel	2070.00		J	MS
7440-09-7	Potassium	514.00		J	MS
7782-49-2	Selenium	1.45	B	J	MS
7440-22-4	Silver	1.92	B	J	MS
7440-23-5	Sodium	757.00		J	MS
7440-28-0	Thallium	0.35	B	J	MS
7440-62-2	Vanadium	22.20		J	MS
7440-66-6	Zinc	312.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: D-2-2

Level: (low/med) Low Date Received: 12/17/08

% Solids: 85.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1050.00			MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	8.24			MS
7440-39-3	Barium	139.00			MS
7440-41-7	Beryllium	0.92			MS
7440-43-9	Cadmium	0.08		J	MS
7440-70-2	Calcium	16400.00			MS
7440-47-3	Chromium	28.10		J	MS
7440-48-4	Cobalt	11.60		J	MS
7440-50-8	Copper	25.90			MS
7439-89-6	Iron	20600.00		J	MS
7439-92-1	Lead	531.00			MS
7439-95-4	Magnesium	9280.00			MS
7439-96-5	Manganese	558.00			MS
7439-97-6	Mercury	1.04		J	MS
7440-02-0	Nickel	88.00		J	MS
7440-09-7	Potassium	869.00			MS
7782-49-2	Selenium	0.05	B	J	MS
7440-22-4	Silver	0.32	B	J	MS
7440-23-5	Sodium	279.00	B	J	MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	25.80			MS
7440-66-6	Zinc	70.10			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-2-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: D-2-3

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 89.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6760.00			MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	6.45			MS
7440-39-3	Barium	43.20			MS
7440-41-7	Beryllium	0.51			MS
7440-43-9	Cadmium	0.04		J	MS
7440-70-2	Calcium	1340.00			MS
7440-47-3	Chromium	15.40		J	MS
7440-48-4	Cobalt	6.46		J	MS
7440-50-8	Copper	9.56			MS
7439-89-6	Iron	19400.00		J	MS
7439-92-1	Lead	26.70			MS
7439-95-4	Magnesium	2017.00			MS
7439-96-5	Manganese	273.00			MS
7439-97-6	Mercury	0.24		J	MS
7440-02-0	Nickel	14.30		J	MS
7440-09-7	Potassium	855.00			MS
7782-49-2	Selenium	0.07	B	J	MS
7440-22-4	Silver	0.02	B	J	MS
7440-23-5	Sodium	63.70	B	J	MS
7440-28-0	Thallium	0.10	B	J	MS
7440-62-2	Vanadium	25.20			MS
7440-66-6	Zinc	43.10			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: E-1-1

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 79.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6095.00			MS
7440-36-0	Antimony	3.19		J	MS
7440-38-2	Arsenic	7.62			MS
7440-39-3	Barium	777.00			MS
7440-41-7	Beryllium	0.50	B		MS
7440-43-9	Cadmium	4.52		J	MS
7440-70-2	Calcium	30900.00			MS
7440-47-3	Chromium	24.00		J	MS
7440-48-4	Cobalt	7.48		J	MS
7440-50-8	Copper	262.00			MS
7439-89-6	Iron	25200.00		J	MS
7439-92-1	Lead	8330.00			MS
7439-95-4	Magnesium	10400.00			MS
7439-96-5	Manganese	387.00			MS
7439-97-6	Mercury	0.59		J	MS
7440-02-0	Nickel	49.90		J	MS
7440-09-7	Potassium	795.00			MS
7782-49-2	Selenium	0.48	B	J	MS
7440-22-4	Silver	1.53	B	J	MS
7440-23-5	Sodium	342.00	B	J	MS
7440-28-0	Thallium	0.16	B	J	MS
7440-62-2	Vanadium	23.40			MS
7440-66-6	Zinc	2180.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-1-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: E-1-2

Level: (low/med) Low Date Received: 12/17/08

% Solids: 86.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4680.00			MS
7440-36-0	Antimony	3.29	B	J	MS
7440-38-2	Arsenic	8.52			MS
7440-39-3	Barium	606.00			MS
7440-41-7	Beryllium	0.37	B		MS
7440-43-9	Cadmium	2.44		J	MS
7440-70-2	Calcium	22400.00			MS
7440-47-3	Chromium	23.10		J	MS
7440-48-4	Cobalt	6.25		J	MS
7440-50-8	Copper	257.00			MS
7439-89-6	Iron	22000.00		J	MS
7439-92-1	Lead	5702.00			MS
7439-95-4	Magnesium	7360.00			MS
7439-96-5	Manganese	326.00			MS
7439-97-6	Mercury	0.58		J	MS
7440-02-0	Nickel	51.40		J	MS
7440-09-7	Potassium	642.00			MS
7782-49-2	Selenium	0.46	B	J	MS
7440-22-4	Silver	1.24	B	J	MS
7440-23-5	Sodium	294.00	B	J	MS
7440-28-0	Thallium	0.15	B	J	MS
7440-62-2	Vanadium	21.50			MS
7440-66-6	Zinc	1260.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-1-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: E-1-3

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 76.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5660.00			MS
7440-36-0	Antimony	4.39	B	J	MS
7440-38-2	Arsenic	8.73			MS
7440-39-3	Barium	1460.00			MS
7440-41-7	Beryllium	0.44	B		MS
7440-43-9	Cadmium	14.90		J	MS
7440-70-2	Calcium	31500.00			MS
7440-47-3	Chromium	67.00		J	MS
7440-48-4	Cobalt	10.40		J	MS
7440-50-8	Copper	1380.00			MS
7439-89-6	Iron	56300.00		J	MS
7439-92-1	Lead	14500.00			MS
7439-95-4	Magnesium	7290.00			MS
7439-96-5	Manganese	602.00			MS
7439-97-6	Mercury	0.66		J	MS
7440-02-0	Nickel	142.00		J	MS
7440-09-7	Potassium	762.00			MS
7782-49-2	Selenium	0.75	B	J	MS
7440-22-4	Silver	7.24	B	J	MS
7440-23-5	Sodium	553.00		J	MS
7440-28-0	Thallium	0.21	B	J	MS
7440-62-2	Vanadium	21.60			MS
7440-66-6	Zinc	7660.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: E-2-1

Level: (low/med) Low Date Received: 12/17/08

% Solids: 77.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8780.00			MS
7440-36-0	Antimony	0.55	B	J	MS
7440-38-2	Arsenic	7.50			MS
7440-39-3	Barium	207.00			MS
7440-41-7	Beryllium	0.71			MS
7440-43-9	Cadmium	0.85		J	MS
7440-70-2	Calcium	11100.00			MS
7440-47-3	Chromium	32.00		J	MS
7440-48-4	Cobalt	7.37		J	MS
7440-50-8	Copper	81.10			MS
7439-89-6	Iron	26400.00		J	MS
7439-92-1	Lead	1920.00			MS
7439-95-4	Magnesium	3230.00			MS
7439-96-5	Manganese	264.00			MS
7439-97-6	Mercury	0.70		J	MS
7440-02-0	Nickel	34.40		J	MS
7440-09-7	Potassium	1180.00			MS
7782-49-2	Selenium	0.45	B	J	MS
7440-22-4	Silver	0.64	B	J	MS
7440-23-5	Sodium	239.00	B	J	MS
7440-28-0	Thallium	0.24	B	J	MS
7440-62-2	Vanadium	31.70			MS
7440-66-6	Zinc	299.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: E-2-2

Level: (low/med) Low Date Received: 12/17/08

% Solids: 87.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	11700.00			MS
7440-36-0	Antimony	0.64	B	J	MS
7440-38-2	Arsenic	10.30			MS
7440-39-3	Barium	215.00			MS
7440-41-7	Beryllium	0.76			MS
7440-43-9	Cadmium	0.88		J	MS
7440-70-2	Calcium	20600.00			MS
7440-47-3	Chromium	35.20		J	MS
7440-48-4	Cobalt	11.60		J	MS
7440-50-8	Copper	63.70			MS
7439-89-6	Iron	27600.00		J	MS
7439-92-1	Lead	1730.00			MS
7439-95-4	Magnesium	5620.00			MS
7439-96-5	Manganese	1401.00			MS
7439-97-6	Mercury	0.87		J	MS
7440-02-0	Nickel	42.80		J	MS
7440-09-7	Potassium	1550.00			MS
7782-49-2	Selenium	0.17	B	J	MS
7440-22-4	Silver	0.73	B	J	MS
7440-23-5	Sodium	249.00	B	J	MS
7440-28-0	Thallium	0.17	B	J	MS
7440-62-2	Vanadium	36.70			MS
7440-66-6	Zinc	338.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-2-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: E-2-3

Level: (low/med) Low Date Received: 12/17/08

% Solids: 85.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7510.0			MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	7.47			MS
7440-39-3	Barium	40.50			MS
7440-41-7	Beryllium	0.48			MS
7440-43-9	Cadmium	0.02	B	J	MS
7440-70-2	Calcium	1650.00			MS
7440-47-3	Chromium	28.50		J	MS
7440-48-4	Cobalt	6.31		J	MS
7440-50-8	Copper	10.90			MS
7439-89-6	Iron	29600.00		J	MS
7439-92-1	Lead	29.20			MS
7439-95-4	Magnesium	1430.00			MS
7439-96-5	Manganese	209.00			MS
7439-97-6	Mercury	0.10		J	MS
7440-02-0	Nickel	16.96		J	MS
7440-09-7	Potassium	1370.00			MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.02	B	J	MS
7440-23-5	Sodium	106.00	B	J	MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	26.50			MS
7440-66-6	Zinc	142.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

O-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil

Lab Sample ID: O-1

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 80.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	11500.00			MS
7440-36-0	Antimony	0.93	B	J	MS
7440-38-2	Arsenic	7.61			MS
7440-39-3	Barium	258.00			MS
7440-41-7	Beryllium	0.97			MS
7440-43-9	Cadmium	1.24		J	MS
7440-70-2	Calcium	25600.00			MS
7440-47-3	Chromium	62.80		J	MS
7440-48-4	Cobalt	18.20		J	MS
7440-50-8	Copper	239.00			MS
7439-89-6	Iron	30600.00		J	MS
7439-92-1	Lead	2760.00			MS
7439-95-4	Magnesium	14020.00			MS
7439-96-5	Manganese	592.00			MS
7439-97-6	Mercury	0.32		J	MS
7440-02-0	Nickel	154.00		J	MS
7440-09-7	Potassium	1850.00			MS
7782-49-2	Selenium	0.34	B	J	MS
7440-22-4	Silver	0.69	B	J	MS
7440-23-5	Sodium	542.00		J	MS
7440-28-0	Thallium	0.23	B	J	MS
7440-62-2	Vanadium	43.10			MS
7440-66-6	Zinc	919.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

O-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0

Matrix: (soil/water) Soil Lab Sample ID: O-2

Level: (low/med) Low Date Received: 12/15/08

% Solids: 93.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3706.00			MS
7440-36-0	Antimony	0.62	B	J	MS
7440-38-2	Arsenic	2.49			MS
7440-39-3	Barium	70.30			MS
7440-41-7	Beryllium	0.22	B		MS
7440-43-9	Cadmium	0.29		J	MS
7440-70-2	Calcium	14400.00			MS
7440-47-3	Chromium	45.50		J	MS
7440-48-4	Cobalt	5.90		J	MS
7440-50-8	Copper	62.10			MS
7439-89-6	Iron	13800.00		J	MS
7439-92-1	Lead	383.00			MS
7439-95-4	Magnesium	7960.00			MS
7439-96-5	Manganese	189.00			MS
7439-97-6	Mercury	0.05		J	MS
7440-02-0	Nickel	69.80		J	MS
7440-09-7	Potassium	861.00			MS
7782-49-2	Selenium	0.16	B	J	MS
7440-22-4	Silver	1.58	B	J	MS
7440-23-5	Sodium	448.00		J	MS
7440-28-0	Thallium	0.12	B	J	MS
7440-62-2	Vanadium	16.00			MS
7440-66-6	Zinc	276.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

Case# Jewett1 Site Jewett Lead Matrix Soil: 20

SDG# A-5-0 Lab U.S. EPA Region 2 Mobile Lab Water: 00

Contractor Not Applicable Reviewer Robert Finke Other: 00

A.2.1 Validation Flags- The following flags have been applied in red by the data validator
Which must be considered by the data user.

- J - This flag indicates that a result is qualified as estimated.
- UJ - This flag indicates that the analyte was analyzed but not detected
And is to be considered as estimated because it may be inaccurate
or imprecise.
- R - This flag indicates that the sample result is to be considered
unusable due to significant error and must not be used by the data
user.

Fully Usable Data - Results which carry a "J" or "UJ" are considered to be fully usable.

Contractual Qualifiers - The legend of the contractual qualifiers applied by the laboratory
On the Form I's are found on page B-20 of SOW ILM04.0.

A.2.2 The data assessment is given below and on the attached data sheets

This SDG (A-5-0) consists of 20 soil samples collected on December 15-18, 2008 from the Jewett Lead Superfund site on Staten Island, NY. The samples were prepared on January 5, 2009 and analyzed on January 27, 2009 by the U.S. EPA Region 2 Mobile Analytical Laboratory for the 22 routine Target Analyte List (TAL) metals and mercury with full Contract Laboratory Program (CLP) Quality Control (QC). This analysis was conducted according to SOP MAL-3.07A which is based upon U.S. EPA CLP SOW ILM04.0, SW-846 Method 6010A, and the U.S. EPA Region 2 DESA Laboratory protocol. Upon completion of this analysis and compiling the results, a formal validation was performed to assure the data contained in this analytical report are of appropriate quality. This being performed as part of the requirements of the Quality Assurance (QA) program put forth for the U.S. EPA Region 2 Mobile Analytical Laboratory to ensure its proper operation. This review and evaluation was carried out according to the U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review and U.S. EPA Region 2 Data Validation SOP Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW. 3/90, Rev. XI. It applies to a systematic approach for examining analytical results to identify and assess the indication of bias to render an overall determination of data usability. In doing so, the data user is assured as to how well a given set of analytical results will conform to the established environmental monitoring performance criteria defined for their project. In accordance, the following qualifications are

applied to this data set which must be considered when utilizing these results to make sound environmental decisions.

1. Laboratory Control Sample

The Laboratory Control Sample (LCS) "found" value for **cadmium and nickel** were greater than the upper acceptable range and have therefore been qualified estimated "J" in all samples contained in this SDG. The Laboratory Control Sample (LCS) "found" value for **cobalt and chromium** were lower than the lower acceptable range and have therefore been qualified estimated "J" in all samples contained in this samples contained in this SDG.

2. Matrix Spike

The matrix spike recovery of **antimony and silver** was between 10-74%. Therefore, all **antimony and silver** data contained in this SDG has been qualified estimated "J".

3. Serial Dilution

The serial dilution result was greater than 10 percent different than the non-diluted sample for **sodium, chromium, iron, nickel, selenium, cadmium, antimony, mercury and thallium**. All results for these elements were greater than ten times the IDL and have therefore been qualified estimated "J" in all samples contained in this SDG.

4.

Percent Solids

Sample C-3-2, possessed less than 50% solids. All elements in this sample has therefore been qualified estimated "J"

U.S. EPA

COVER PAGE

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: MODSW846 6020ALab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-5-0SOW No.: N/AEPA Sample No.Lab Sample ID

B-1-0
B-2-0
B-3-0
B-4-0
C-1-0
A-5-0(D)
A-5-0(S)
A-5-0(L)
C-2-0
C-3-0
D-1-0
D-2-0
E-1-0
E-1-0(D)
E-1-0(S)
E-1-0(L)
E-2-0
G-2-0
G-2-2
G-3-3
G-5-1
O-3
O-4

B-1-0
B-2-0
B-3-0
B-4-0
C-1-0
A-5-0(D)
A-5-0(S)
A-5-0(L)
C-2-0
C-3-0
D-1-0
D-2-0
E-2-0
E-1-0(D)
E-1-0(S)
E-1-0(L)
E-2-0
G-2-0
G-2-2
G-3-3
G-5-1
O-3
O-4

ICP-AES ICP-MS

Were ICP-AES and ICP-MS interelement
corrections applied?

(Yes/No)

No

Were ICP-AES and ICP-MS background corrections
applied?

(Yes/No)

No

If yes, were raw data generated before
application of background corrections?

(Yes/No)

No

Comments:

(D) = Laboratory Matrix Duplicate Sample, (S) = Laboratory Matrix Spike
sample (L) = Serial Dilution Sample

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: B-1-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 82.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7020.00			MS
7440-36-0	Antimony	0.97	B		MS
7440-38-2	Arsenic	7.25			MS
7440-39-3	Barium	177.00		J	MS
7440-41-7	Beryllium	0.52	B		MS
7440-43-9	Cadmium	0.63		J	MS
7440-70-2	Calcium	29000.00			MS
7440-47-3	Chromium	19.00		J-	MS
7440-48-4	Cobalt	7.60		J	MS
7440-50-8	Copper	75.30			MS
7439-89-6	Iron	16500.00			MS
7439-92-1	Lead	13400.00		J	MS
7439-95-4	Magnesium	8740.00			MS
7439-96-5	Manganese	538.00		J	MS
7439-97-6	Mercury	0.27		J	MS
7440-02-0	Nickel	37.00		J	MS
7440-09-7	Potassium	951.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.50	B	J	MS
7440-23-5	Sodium	301.00	B	J	MS
7440-28-0	Thallium	0.15	B		MS
7440-62-2	Vanadium	25.80		J	MS
7440-66-6	Zinc	166.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: B-2-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 90.3

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4960.00			MS
7440-36-0	Antimony	0.23	B	J	MS
7440-38-2	Arsenic	2.75		J	MS
7440-39-3	Barium	52.40		J	MS
7440-41-7	Beryllium	0.35	B		MS
7440-43-9	Cadmium	0.17		J	MS
7440-70-2	Calcium	11500.00			MS
7440-47-3	Chromium	24.70		J	MS
7440-48-4	Cobalt	7.98		J	MS
7440-50-8	Copper	18.60		J	MS
7439-89-6	Iron	11600.00			MS
7439-92-1	Lead	456.00		J	MS
7439-95-4	Magnesium	5830.00			MS
7439-96-5	Manganese	243.00		J	MS
7439-97-6	Mercury	0.07		J	MS
7440-02-0	Nickel	92.70		J	MS
7440-09-7	Potassium	872.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.16	B	J	MS
7440-23-5	Sodium	555.00		J	MS
7440-28-0	Thallium	0.10	B		MS
7440-62-2	Vanadium	15.80		J	MS
7440-66-6	Zinc	70.60			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-3-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: B-3-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 90.3

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4980.00			MS
7440-36-0	Antimony	0.41	B	J	MS
7440-38-2	Arsenic	3.47		J	MS
7440-39-3	Barium	66.40		J	MS
7440-41-7	Beryllium	0.55	B		MS
7440-43-9	Cadmium	0.24		J	MS
7440-70-2	Calcium	7320.00			MS
7440-47-3	Chromium	18.60		J	MS
7440-48-4	Cobalt	6.97		J	MS
7440-50-8	Copper	27.30		J	MS
7439-89-6	Iron	11900.00			MS
7439-92-1	Lead	319.00		J	MS
7439-95-4	Magnesium	4204.00			MS
7439-96-5	Manganese	253.00		J	MS
7439-97-6	Mercury	0.07		J	MS
7440-02-0	Nickel	52.50		J	MS
7440-09-7	Potassium	1005.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.21	B	J	MS
7440-23-5	Sodium	404.00	B	J	MS
7440-28-0	Thallium	0.11	B		MS
7440-62-2	Vanadium	19.30		J	MS
7440-66-6	Zinc	102.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-4-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: B-4-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 84.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	13500.00			MS
7440-36-0	Antimony	0.36	B	J	MS
7440-38-2	Arsenic	3.97		J	MS
7440-39-3	Barium	70.40		J	MS
7440-41-7	Beryllium	0.60	B		MS
7440-43-9	Cadmium	0.27		J	MS
7440-70-2	Calcium	15200.00			MS
7440-47-3	Chromium	59.20		J	MS
7440-48-4	Cobalt	23.30		J	MS
7440-50-8	Copper	32.40		J	MS
7439-89-6	Iron	17200.00			MS
7439-92-1	Lead	538.00		J	MS
7439-95-4	Magnesium	13500.00			MS
7439-96-5	Manganese	347.00		J	MS
7439-97-6	Mercury	0.08		J	MS
7440-02-0	Nickel	317.00		J	MS
7440-09-7	Potassium	1550.00		J	MS
7782-49-2	Selenium	0.11	U	J	MS
7440-22-4	Silver	0.21	B	J	MS
7440-23-5	Sodium	3401.00		J	MS
7440-28-0	Thallium	0.17	B		MS
7440-62-2	Vanadium	24.10		J	MS
7440-66-6	Zinc	101.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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EPA SAMPLE NO.

C-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: C-1-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 85.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6200.00			MS
7440-36-0	Antimony	1.50	B	J	MS
7440-38-2	Arsenic	6.83		J	MS
7440-39-3	Barium	171.00		J	MS
7440-41-7	Beryllium	0.38	B		MS
7440-43-9	Cadmium	0.80		J	MS
7440-70-2	Calcium	28100.00			MS
7440-47-3	Chromium	15.80		J	MS
7440-48-4	Cobalt	6.55		J	MS
7440-50-8	Copper	148.00		J	MS
7439-89-6	Iron	14000.00			MS
7439-92-1	Lead	11500.00		J	MS
7439-95-4	Magnesium	7060.00			MS
7439-96-5	Manganese	435.00		J	MS
7439-97-6	Mercury	0.22		J	MS
7440-02-0	Nickel	32.00		J	MS
7440-09-7	Potassium	864.00		J	MS
7782-49-2	Selenium	0.02	U	J	MS
7440-22-4	Silver	0.55	B	J	MS
7440-23-5	Sodium	387.00	B	J	MS
7440-28-0	Thallium	0.15	B		MS
7440-62-2	Vanadium	21.20		J	MS
7440-66-6	Zinc	282.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: C-2-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 90.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4280.00			MS
7440-36-0	Antimony	0.05	B	J	MS
7440-38-2	Arsenic	1.95		J	MS
7440-39-3	Barium	45.90		J	MS
7440-41-7	Beryllium	0.37	B		MS
7440-43-9	Cadmium	0.15		J	MS
7440-70-2	Calcium	3850.00			MS
7440-47-3	Chromium	15.60		J	MS
7440-48-4	Cobalt	7.32		J	MS
7440-50-8	Copper	15.80		J	MS
7439-89-6	Iron	9960.00			MS
7439-92-1	Lead	227.00		J	MS
7439-95-4	Magnesium	3500.00			MS
7439-96-5	Manganese	268.00		J	MS
7439-97-6	Mercury	0.05		J	MS
7440-02-0	Nickel	71.60		J	MS
7440-09-7	Potassium	822.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.13	B	J	MS
7440-23-5	Sodium	352.00	B	J	MS
7440-28-0	Thallium	0.10	B		MS
7440-62-2	Vanadium	13.90		J	MS
7440-66-6	Zinc	58.10			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
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EPA SAMPLE NO.

C-3-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: C-3-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 84.9

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4770.00			MS
7440-36-0	Antimony	0.20	B		MS
7440-38-2	Arsenic	2.70			MS
7440-39-3	Barium	84.50		J	MS
7440-41-7	Beryllium	0.34	B		MS
7440-43-9	Cadmium	1.83		J	MS
7440-70-2	Calcium	6940.00			MS
7440-47-3	Chromium	23.20		J	MS
7440-48-4	Cobalt	8.38		J	MS
7440-50-8	Copper	22.60			MS
7439-89-6	Iron	12100.00			MS
7439-92-1	Lead	471.00		J	MS
7439-95-4	Magnesium	7240.00			MS
7439-96-5	Manganese	228.00		J	MS
7439-97-6	Mercury	0.12		J	MS
7440-02-0	Nickel	99.80		J	MS
7440-09-7	Potassium	1160.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.17	B	J	MS
7440-23-5	Sodium	504.00		J	MS
7440-28-0	Thallium	0.10	B		MS
7440-62-2	Vanadium	16.45			MS
7440-66-6	Zinc	94.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: D-1-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 85.3

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6320.00			MS
7440-36-0	Antimony	1.47	B	J	MS
7440-38-2	Arsenic	6.88		J	MS
7440-39-3	Barium	205.00		J	MS
7440-41-7	Beryllium	0.37	B		MS
7440-43-9	Cadmium	1.06		J	MS
7440-70-2	Calcium	34000.00			MS
7440-47-3	Chromium	17.50		J	MS
7440-48-4	Cobalt	6.88		J	MS
7440-50-8	Copper	123.00		J	MS
7439-89-6	Iron	15400.00			MS
7439-92-1	Lead	6580.00		J	MS
7439-95-4	Magnesium	10700.00			MS
7439-96-5	Manganese	376.00		J	MS
7439-97-6	Mercury	0.35		J	MS
7440-02-0	Nickel	33.50		J	MS
7440-09-7	Potassium	798.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.48	B	J	MS
7440-23-5	Sodium	369.00	B	J	MS
7440-28-0	Thallium	0.14	B		MS
7440-62-2	Vanadium	24.10		J	MS
7440-66-6	Zinc	380.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: D-2-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 89.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5740.00			MS
7440-36-0	Antimony	0.41	B	J	MS
7440-38-2	Arsenic	3.66		J	MS
7440-39-3	Barium	115.00		J	MS
7440-41-7	Beryllium	0.38	B		MS
7440-43-9	Cadmium	0.44		J	MS
7440-70-2	Calcium	12300.00			MS
7440-47-3	Chromium	19.60		J	MS
7440-48-4	Cobalt	8.31		J	MS
7440-50-8	Copper	43.28		J	MS
7439-89-6	Iron	14500.00			MS
7439-92-1	Lead	1210.00		J	MS
7439-95-4	Magnesium	3870.00			MS
7439-96-5	Manganese	255.00		J	MS
7439-97-6	Mercury	0.28		J	MS
7440-02-0	Nickel	56.60		J	MS
7440-09-7	Potassium	894.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.27	B	J	MS
7440-23-5	Sodium	351.00	B	J	MS
7440-28-0	Thallium	0.12	B		MS
7440-62-2	Vanadium	17.00		J	MS
7440-66-6	Zinc	385.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-1-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: E-1-0

Level: (low/med) Low

Date Received: 12/15/08

% Solids: 93.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3930.00			MS
7440-36-0	Antimony	0.17	B		MS
7440-38-2	Arsenic	2.30			MS
7440-39-3	Barium	49.70		J	MS
7440-41-7	Beryllium	0.30	B		MS
7440-43-9	Cadmium	0.24		J	MS
7440-70-2	Calcium	3720.00			MS
7440-47-3	Chromium	28.70		J	MS
7440-48-4	Cobalt	6.05		J	MS
7440-50-8	Copper	23.00			MS
7439-89-6	Iron	9510.00			MS
7439-92-1	Lead	415.00		J	MS
7439-95-4	Magnesium	2840.00			MS
7439-96-5	Manganese	203.00		J	MS
7439-97-6	Mercury	0.21		J	MS
7440-02-0	Nickel	102.00		J	MS
7440-09-7	Potassium	614.00		J	MS
7782-49-2	Selenium	0.15	U	J	MS
7440-22-4	Silver	0.20	B	J	MS
7440-23-5	Sodium	382.00	B	J	MS
7440-28-0	Thallium	0.37	B		MS
7440-62-2	Vanadium	12.90			MS
7440-66-6	Zinc	74.40		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

E-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: E-2-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 77.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6940.00			MS
7440-36-0	Antimony	3.12	B		MS
7440-38-2	Arsenic	7.29			MS
7440-39-3	Barium	133.00		J	MS
7440-41-7	Beryllium	0.47	B		MS
7440-43-9	Cadmium	0.91		J	MS
7440-70-2	Calcium	31200.00			MS
7440-47-3	Chromium	20.30		J	MS
7440-48-4	Cobalt	8.43		J	MS
7440-50-8	Copper	76.30			MS
7439-89-6	Iron	17100.00			MS
7439-92-1	Lead	2710.00		J	MS
7439-95-4	Magnesium	8900.00			MS
7439-96-5	Manganese	380.00		J	MS
7439-97-6	Mercury	0.31		J /	MS
7440-02-0	Nickel	52.20		J	MS
7440-09-7	Potassium	1140.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.47	B	J	MS
7440-23-5	Sodium	360.00	B	J	MS
7440-28-0	Thallium	0.15	B		MS
7440-62-2	Vanadium	23.50			MS
7440-66-6	Zinc	293.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

G-2-0

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: G-2-0

Level: (low/med) Low Date Received: 12/15/08

% Solids: 89.3

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6610.00			MS
7440-36-0	Antimony	0.47	B		MS
7440-38-2	Arsenic	4.81			MS
7440-39-3	Barium	132.00		J	MS
7440-41-7	Beryllium	0.42	B		MS
7440-43-9	Cadmium	0.61		J	MS
7440-70-2	Calcium	12200.00			MS
7440-47-3	Chromium	46.20		J	MS
7440-48-4	Cobalt	8.34		J	MS
7440-50-8	Copper	46.70			MS
7439-89-6	Iron	14800.00			MS
7439-92-1	Lead	1450.00		J	MS
7439-95-4	Magnesium	4304.00			MS
7439-96-5	Manganese	309.00		J	MS
7439-97-6	Mercury	0.31		J	MS
7440-02-0	Nickel	86.60		J	MS
7440-09-7	Potassium	951.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.28	B	J	MS
7440-23-5	Sodium	446.00	B	J	MS
7440-28-0	Thallium	0.14	B		MS
7440-62-2	Vanadium	20.30			MS
7440-66-6	Zinc	200.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

G-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: G-2-2

Level: (low/med) Low Date Received: 12/18/08

% Solids: 51.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2850.00			MS
7440-36-0	Antimony	11.70	B		MS
7440-38-2	Arsenic	4.49			MS
7440-39-3	Barium	1520.00		J	MS
7440-41-7	Beryllium	0.27	B		MS
7440-43-9	Cadmium	3.86		J	MS
7440-70-2	Calcium	20050.00			MS
7440-47-3	Chromium	26.20		J	MS
7440-48-4	Cobalt	6.96		J	MS
7440-50-8	Copper	154.00			MS
7439-89-6	Iron	9570.00			MS
7439-92-1	Lead	240000.00		J	MS
7439-95-4	Magnesium	13500.00			MS
7439-96-5	Manganese	3080.00		J	MS
7439-97-6	Mercury	1.16		J	MS
7440-02-0	Nickel	196.00		J	MS
7440-09-7	Potassium	568.00		J	MS
7782-49-2	Selenium	0.62	B	J	MS
7440-22-4	Silver	7.83		J	MS
7440-23-5	Sodium	1160.00		J	MS
7440-28-0	Thallium	0.61	B		MS
7440-62-2	Vanadium	6.85			MS
7440-66-6	Zinc	244.00		J	MS

Color Before: Brown Clarity Before: N/A Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

G-3-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil

Lab Sample ID: G-3-3

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 86.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6304.00			MS
7440-36-0	Antimony	0.03	B		MS
7440-38-2	Arsenic	5.57			MS
7440-39-3	Barium	23.50		J	MS
7440-41-7	Beryllium	0.40	B		MS
7440-43-9	Cadmium	0.13		J	MS
7440-70-2	Calcium	1120.00			MS
7440-47-3	Chromium	41.50		J	MS
7440-48-4	Cobalt	6.28		J	MS
7440-50-8	Copper	25.70			MS
7439-89-6	Iron	15100.00			MS
7439-92-1	Lead	68.90		J	MS
7439-95-4	Magnesium	2610.00			MS
7439-96-5	Manganese	165.00		J	MS
7439-97-6	Mercury	0.08		J	MS
7440-02-0	Nickel	49.30		J	MS
7440-09-7	Potassium	816.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.07	B	J	MS
7440-23-5	Sodium	222.00	B	J	MS
7440-28-0	Thallium	0.16	B		MS
7440-62-2	Vanadium	17.00			MS
7440-66-6	Zinc	57.70		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

G-5-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: G-5-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 76.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6830.00			MS
7440-36-0	Antimony	5.10	B		MS
7440-38-2	Arsenic	7.71			MS
7440-39-3	Barium	417.00		J	MS
7440-41-7	Beryllium	0.56	B		MS
7440-43-9	Cadmium	1.98		J	MS
7440-70-2	Calcium	62700.00			MS
7440-47-3	Chromium	36.40		J	MS
7440-48-4	Cobalt	9.51		J	MS
7440-50-8	Copper	330.00			MS
7439-89-6	Iron	16100.00			MS
7439-92-1	Lead	31400.00		J	MS
7439-95-4	Magnesium	10100.00			MS
7439-96-5	Manganese	830.00		J	MS
7439-97-6	Mercury	0.66		J	MS
7440-02-0	Nickel	119.00		J	MS
7440-09-7	Potassium	1160.00		J	MS
7782-49-2	Selenium	0.77	U	J	MS
7440-22-4	Silver	0.96	B	J	MS
7440-23-5	Sodium	628.00		J	MS
7440-28-0	Thallium	0.45	B		MS
7440-62-2	Vanadium	23.70			MS
7440-66-6	Zinc	673.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

O-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: O-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 79.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4270.00			MS
7440-36-0	Antimony	0.60	B		MS
7440-38-2	Arsenic	2.18			MS
7440-39-3	Barium	79.70		J	MS
7440-41-7	Beryllium	0.34	B		MS
7440-43-9	Cadmium	0.35	B	J	MS
7440-70-2	Calcium	20700.00			MS
7440-47-3	Chromium	51.60		J	MS
7440-48-4	Cobalt	5.33		J	MS
7440-50-8	Copper	71.10			MS
7439-89-6	Iron	16100.00			MS
7439-92-1	Lead	578.00		J	MS
7439-95-4	Magnesium	9702.00			MS
7439-96-5	Manganese	243.00		J	MS
7439-97-6	Mercury	0.11		J	MS
7440-02-0	Nickel	49.20		J	MS
7440-09-7	Potassium	922.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.17	B	J	MS
7440-23-5	Sodium	715.00		J	MS
7440-28-0	Thallium	0.17	B		MS
7440-62-2	Vanadium	15.30			MS
7440-66-6	Zinc	256.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

O-4

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: E-1-0

Matrix: (soil/water) Soil Lab Sample ID: O-4

Level: (low/med) Low Date Received: 12/18/08

% Solids: 74.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6180.0			MS
7440-36-0	Antimony	1.62	B		MS
7440-38-2	Arsenic	4.14			MS
7440-39-3	Barium	156.00		J	MS
7440-41-7	Beryllium	0.35	B		MS
7440-43-9	Cadmium	0.70		J	MS
7440-70-2	Calcium	23500.00			MS
7440-47-3	Chromium	47.20		J	MS
7440-48-4	Cobalt	8.49		J	MS
7440-50-8	Copper	206.00			MS
7439-89-6	Iron	26200.00			MS
7439-92-1	Lead	682.00		J	MS
7439-95-4	Magnesium	10700.00			MS
7439-96-5	Manganese	365.00		J	MS
7439-97-6	Mercury	0.18		J	MS
7440-02-0	Nickel	55.30		J	MS
7440-09-7	Potassium	1150.00		J	MS
7782-49-2	Selenium	0.03	U	J	MS
7440-22-4	Silver	0.36	B	J	MS
7440-23-5	Sodium	865.00		J	MS
7440-28-0	Thallium	0.16	B		MS
7440-62-2	Vanadium	27.40			MS
7440-66-6	Zinc	933.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

Case# Jewett1 Site Jewett Lead Matrix Soil: 17

SDG# E-1-0 Lab U.S. EPA Region 2 Mobile Lab Water: 00

Contractor Not Applicable Reviewer Robert Finke Other: 00

A.2.1 Validation Flags- The following flags have been applied in red by the data validator
Which must be considered by the data user.

- J - This flag indicates that a result is qualified as estimated.
- UJ - This flag indicates that the analyte was analyzed but not detected
And is to be considered as estimated because it may be inaccurate
or imprecise.
- R - This flag indicates that the sample result is to be considered
unusable due to significant error and must not be used by the data
user.

Fully Usable Data - Results which carry a "J" or "UJ" are considered to be fully usable.

Contractual Qualifiers - The legend of the contractual qualifiers applied by the laboratory
On the Form I's are found on page B-20 of SOW ILM04.0.

A.2.2 The data assessment is given below and on the attached data sheets

This SDG (E-1-0) consists of 17 soil samples collected on December 15, 2008 from the Jewett Lead Superfund site on Staten Island, NY. The samples were prepared on January 7, 2009 and analyzed on January 28, 2009 by the U.S. EPA Region 2 Mobile Analytical Laboratory for the 22 routine Target Analyte List (TAL) metals and mercury with full Contract Laboratory Program (CLP) Quality Control (QC). This analysis was conducted according to SOP MAL-3.07A which is based upon U.S. EPA CLP SOW ILM04.0, SW-846 Method 6010A, and the U.S. EPA Region 2 DESA Laboratory protocol. Upon completion of this analysis and compiling the results, a formal validation was performed to assure the data contained in this analytical report are of appropriate quality. This being performed as part of the requirements of the Quality Assurance (QA) program put forth for the U.S. EPA Region 2 Mobile Analytical Laboratory to ensure its proper operation. This review and evaluation was carried out according to the U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review and U.S. EPA Region 2 Data Validation SOP Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW. 3/90, Rev. XI. It applies to a systematic approach for examining analytical results to identify and assess the indication of bias to render an overall determination of data usability. In doing so, the data user is assured as to how well a given set of analytical results will conform to the established environmental monitoring performance criteria defined for their project. In accordance, the following qualifications are

applied to this data set which must be considered when utilizing these results to make sound environmental decisions.

1. Calibration

The results of an Continuing Calibration Verification (CCV) determination yielded recoveries which were not within the specified control limits of 90-110%R. This requires that the associated results be qualified as estimated "J" in the affected environmental samples, resulting in the following required action(s.)

Element(s)	%R	Qualification	Sample(s) Qualified
Manganese (CCV-1)	112.5	J	E-1-0, G-5-1, G-3-3
Nickel (CCV-2)	87.4	J	C-1-0, C-2-0, C-3-0, D-1-0, D-2-0, B-1-0, B-2-0, B-3-0, B-4-0
Copper (CCV-2)	89.0	J	C-1-0, C-2-0, C-3-0, D-1-0, D-2-0, B-1-0, B-2-0, B-3-0, B-4-0
Arsenic (CCV-2)	82.7	J	C-1-0, C-2-0, C-3-0, D-1-0, D-2-0, B-1-0, B-2-0, B-3-0, B-4-0
Silver (CCV-2)	77.4	J	C-1-0, C-2-0, C-3-0, D-1-0, D-2-0, B-1-0, B-2-0, B-3-0, B-4-0
Antimony (CCV-2)	87.6	J	C-1-0, C-2-0, C-3-0, D-1-0, D-2-0, B-1-0, B-2-0, B-3-0, B-4-0
Manganese (CCV-3)	112.6	J	B-1-0, B-2-0, B-3-0, B-4-0

2. Laboratory Control Sample

The Laboratory Control Sample (LCS) "found" value for **cobalt, chromium, and vanadium** were less than the lower acceptable range and have therefore been qualified estimated "J" in all samples contained in this SDG.

3. Laboratory Duplicate Analysis

The Relative Percent Difference (RPD) between the sample and lab duplicate sample for the element **selenium** was greater than 100%. Therefore **selenium** in sample **E-1-0** has been qualified estimated "J".

4. Matrix Spike

The matrix spike recovery of **barium, cobalt** was between 10-74%. Therefore **barium and cobalt** have been qualified estimated "J" in all samples contained in this SDG.

5. Serial Dilution

The serial dilution result was greater than 10 percent different than the non-diluted sample for **sodium, potassium, chromium, manganese, nickel, selenium, silver, cadmium, mercury and lead**. All results for these elements were greater than ten times the IDL and have therefore been qualified estimated "J" in all samples contained in this SDG.

U.S. EPA

COVER PAGE

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: MODSW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

SOW No.: N/A

EPA Sample No.

Lab Sample ID

A-1-1	A-1-1
A-1-1(D)	A-1-1(D)
A-1-1(S)	1-1-1(S)
A-1-1(L)	A-1-1(L)
A-1-2	A-1-2
A-1-3	A-1-3
A-2-1	A-2-1
A-2-2	A-2-2
A-2-3	A-2-3
A-3-1	A-3-1
A-3-2	A-3-2
A-3-3	A-3-3
A-4-1	A-4-1
A-4-2	A-4-2
A-4-3	A-4-3
A-5-1	A-5-1
A-5-2	A-5-2
A-5-3	A-5-3
B-1-1	B-1-1
B-1-2	B-1-2
B-1-3	B-1-3
B-2-1	B-2-1
B-2-2	B-2-2

ICP-AES ICP-MS

Were ICP-AES and ICP-MS interelement corrections applied?

(Yes/No)

No

Were ICP-AES and ICP-MS background corrections applied?

(Yes/No)

No

If yes, were raw data generated before application of background corrections?

(Yes/No)

No

Comments:

(D) = laboratory matrix duplicate sample, (S) = laboratory matrix spike sample (L) = Serial Dilution sample

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-1-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 79.9

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9290.00			MS
7440-36-0	Antimony	1.92	B	J	MS
7440-38-2	Arsenic	7.35			MS
7440-39-3	Barium	285.00			MS
7440-41-7	Beryllium	0.42	B	J	MS
7440-43-9	Cadmium	1.08			MS
7440-70-2	Calcium	5220.00			MS
7440-47-3	Chromium	28.40		J	MS
7440-48-4	Cobalt	7.55			MS
7440-50-8	Copper	70.80			MS
7439-89-6	Iron	14500.00			MS
7439-92-1	Lead	47700.00			MS
7439-95-4	Magnesium	18100.00			MS
7439-96-5	Manganese	899.00			MS
7439-97-6	Mercury	0.52		J	MS
7440-02-0	Nickel	58.00		J	MS
7440-09-7	Potassium	1005.00			MS
7782-49-2	Selenium	1.36	B	J	MS
7440-22-4	Silver	0.68	B	R	MS
7440-23-5	Sodium	516.00			MS
7440-28-0	Thallium	0.40	B	J	MS
7440-62-2	Vanadium	24.10			MS
7440-66-6	Zinc	183.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
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EPA SAMPLE NO.

A-1-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAI Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-1-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 81.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8560.00			MS
7440-36-0	Antimony	1.66	B	J	MS
7440-38-2	Arsenic	15.00			MS
7440-39-3	Barium	260.00			MS
7440-41-7	Beryllium	0.41	B	J	MS
7440-43-9	Cadmium	0.78			MS
7440-70-2	Calcium	32500.00			MS
7440-47-3	Chromium	33.00		J	MS
7440-48-4	Cobalt	9.08			MS
7440-50-8	Copper	91.60			MS
7439-89-6	Iron	17500.00			MS
7439-92-1	Lead	17600.00			MS
7439-95-4	Magnesium	11400.00			MS
7439-96-5	Manganese	841.00			MS
7439-97-6	Mercury	0.34		J	MS
7440-02-0	Nickel	78.80		J	MS
7440-09-7	Potassium	973.00			MS
7782-49-2	Selenium	0.85	B	J	MS
7440-22-4	Silver	0.56	B	R	MS
7440-23-5	Sodium	311.00	B		MS
7440-28-0	Thallium	0.27	B	J	MS
7440-62-2	Vanadium	26.20			MS
7440-66-6	Zinc	179.00			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-1-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-1-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 84.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	11100.00			MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	9.37			MS
7440-39-3	Barium	36.50			MS
7440-41-7	Beryllium	0.69		J	MS
7440-43-9	Cadmium	0.03			MS
7440-70-2	Calcium	2620.00			MS
7440-47-3	Chromium	26.00		J	MS
7440-48-4	Cobalt	5.18			MS
7440-50-8	Copper	13.10			MS
7439-89-6	Iron	24900.00			MS
7439-92-1	Lead	42.90			MS
7439-95-4	Magnesium	2110.00			MS
7439-96-5	Manganese	187.00			MS
7439-97-6	Mercury	0.08		J	MS
7440-02-0	Nickel	12.90		J	MS
7440-09-7	Potassium	1760.00			MS
7782-49-2	Selenium	0.17	B	J	MS
7440-22-4	Silver	0.02	B	J	MS
7440-23-5	Sodium	208.00	B		MS
7440-28-0	Thallium	0.17	B	J	MS
7440-62-2	Vanadium	40.90			MS
7440-66-6	Zinc	45.70			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-2-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 69.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6250.00			MS
7440-36-0	Antimony	2.68	B	J	MS
7440-38-2	Arsenic	5.67			MS
7440-39-3	Barium	540.00			MS
7440-41-7	Beryllium	0.28	B	J	MS
7440-43-9	Cadmium	1.50			MS
7440-70-2	Calcium	62500.00			MS
7440-47-3	Chromium	12.50		J	MS
7440-48-4	Cobalt	5.55			MS
7440-50-8	Copper	92.40			MS
7439-89-6	Iron	11700.00			MS
7439-92-1	Lead	55500.00			MS
7439-95-4	Magnesium	15020.00			MS
7439-96-5	Manganese	1030.00			MS
7439-97-6	Mercury	0.34		J	MS
7440-02-0	Nickel	34.50		J	MS
7440-09-7	Potassium	678.00			MS
7782-49-2	Selenium	1.24	B	J	MS
7440-22-4	Silver	1.04		J	MS
7440-23-5	Sodium	384.00	B		MS
7440-28-0	Thallium	0.24	B	J	MS
7440-62-2	Vanadium	17.60			MS
7440-66-6	Zinc	140.00			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-2-2

Level: (low/med) Low Date Received: 12/18/08

% Solids: 41.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3410.00		J	MS
7440-36-0	Antimony	5.51	B	J	MS
7440-38-2	Arsenic	3.87		J	MS
7440-39-3	Barium	1170.00		J	MS
7440-41-7	Beryllium	0.04	B	J	MS
7440-43-9	Cadmium	4.61		J	MS
7440-70-2	Calcium	226000.00		J	MS
7440-47-3	Chromium	17.30		J	MS
7440-48-4	Cobalt	4.35		J	MS
7440-50-8	Copper	135.00		J	MS
7439-89-6	Iron	7210.00		J	MS
7439-92-1	Lead	130.000		J	MS
7439-95-4	Magnesium	4940.00		J	MS
7439-96-5	Manganese	6250.00		J	MS
7439-97-6	Mercury	1.15		J	MS
7440-02-0	Nickel	35.30		J	MS
7440-09-7	Potassium	482.00		J	MS
7782-49-2	Selenium	1.55	B	J	MS
7440-22-4	Silver	3.02		J	MS
7440-23-5	Sodium	591.00		J	MS
7440-28-0	Thallium	0.37	B	J	MS
7440-62-2	Vanadium	4.93		J	MS
7440-66-6	Zinc	247.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-2-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-2-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 42.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4190.00		J	MS
7440-36-0	Antimony	7.68		J	MS
7440-38-2	Arsenic	2.81		J	MS
7440-39-3	Barium	1220.00		J	MS
7440-41-7	Beryllium	0.11	B	J	MS
7440-43-9	Cadmium	4.77		J	MS
7440-70-2	Calcium	213000.00		J	MS
7440-47-3	Chromium	13.50		J	MS
7440-48-4	Cobalt	5.12		J	MS
7440-50-8	Copper	87.00		J	MS
7439-89-6	Iron	7760.00		J	MS
7439-92-1	Lead	98700.00		J	MS
7439-95-4	Magnesium	3830.00		J	MS
7439-96-5	Manganese	3980.00		J	MS
7439-97-6	Mercury	1.67		J	MS
7440-02-0	Nickel	42.40		J	MS
7440-09-7	Potassium	681.00		J	MS
7782-49-2	Selenium	1.14	B	J	MS
7440-22-4	Silver	2.21		J	MS
7440-23-5	Sodium	717.00		J	MS
7440-28-0	Thallium	0.49	B	J	MS
7440-62-2	Vanadium	8.58		J	MS
7440-66-6	Zinc	307.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-3-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-3-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 90.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12900.00			MS
7440-36-0	Antimony	0.24	B	J	MS
7440-38-2	Arsenic	6.35			MS
7440-39-3	Barium	86.40			MS
7440-41-7	Beryllium	0.37	B	J	MS
7440-43-9	Cadmium	0.17			MS
7440-70-2	Calcium	1600.00			MS
7440-47-3	Chromium	52.60		J	MS
7440-48-4	Cobalt	10.90			MS
7440-50-8	Copper	41.90			MS
7439-89-6	Iron	21400.00			MS
7439-92-1	Lead	80.10			MS
7439-95-4	Magnesium	2890.00			MS
7439-96-5	Manganese	437.00			MS
7439-97-6	Mercury	0.09		J	MS
7440-02-0	Nickel	68.30		J	MS
7440-09-7	Potassium	1080.00			MS
7782-49-2	Selenium	0.59	B	J	MS
7440-22-4	Silver	0.28	B	J	MS
7440-23-5	Sodium	232.00	B		MS
7440-28-0	Thallium	0.19	B	J	MS
7440-62-2	Vanadium	30.90			MS
7440-66-6	Zinc	59.40			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-3-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-3-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 89.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7404.00			MS
7440-36-0	Antimony	0.17	B	J	MS
7440-38-2	Arsenic	5.49			MS
7440-39-3	Barium	31.20			MS
7440-41-7	Beryllium	0.35	B	J	MS
7440-43-9	Cadmium	0.18			MS
7440-70-2	Calcium	3340.00			MS
7440-47-3	Chromium	44.60		J	MS
7440-48-4	Cobalt	6.84			MS
7440-50-8	Copper	18.70			MS
7439-89-6	Iron	13900.00			MS
7439-92-1	Lead	541.00			MS
7439-95-4	Magnesium	2440.00			MS
7439-96-5	Manganese	166.00			MS
7439-97-6	Mercury	0.06		J	MS
7440-02-0	Nickel	44.50		J	MS
7440-09-7	Potassium	762.00			MS
7782-49-2	Selenium	0.23	B	J	MS
7440-22-4	Silver	0.02	B	J	MS
7440-23-5	Sodium	111.00	B		MS
7440-28-0	Thallium	0.10	B	J	MS
7440-62-2	Vanadium	18.70			MS
7440-66-6	Zinc	68.20			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-3-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-3-3

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 86.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7430.00			MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	4.74			MS
7440-39-3	Barium	22.30			MS
7440-41-7	Beryllium	0.30	B	J	MS
7440-43-9	Cadmium	0.10			MS
7440-70-2	Calcium	1018.00			MS
7440-47-3	Chromium	41.80		J	MS
7440-48-4	Cobalt	5.68			MS
7440-50-8	Copper	33.90			MS
7439-89-6	Iron	13300.00			MS
7439-92-1	Lead	56.50			MS
7439-95-4	Magnesium	2370.00			MS
7439-96-5	Manganese	127.00			MS
7439-97-6	Mercury	0.04		J	MS
7440-02-0	Nickel	28.10		J	MS
7440-09-7	Potassium	669.00			MS
7782-49-2	Selenium	0.09	B	J	MS
7440-22-4	Silver	0.01	B	J	MS
7440-23-5	Sodium	83.90	B		MS
7440-28-0	Thallium	0.07	B	J	MS
7440-62-2	Vanadium	15.60			MS
7440-66-6	Zinc	58.50			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-4-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-4-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 81.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7630.00			MS
7440-36-0	Antimony	3.42	B	J	MS
7440-38-2	Arsenic	6.57			MS
7440-39-3	Barium	311.00			MS
7440-41-7	Beryllium	0.39	B	J	MS
7440-43-9	Cadmium	1.59			MS
7440-70-2	Calcium	65100.00			MS
7440-47-3	Chromium	53.20		J	MS
7440-48-4	Cobalt	5.15			MS
7440-50-8	Copper	84.00			MS
7439-89-6	Iron	13200.00			MS
7439-92-1	Lead	26200.00			MS
7439-95-4	Magnesium	9920.00			MS
7439-96-5	Manganese	746.00			MS
7439-97-6	Mercury	0.43		J	MS
7440-02-0	Nickel	29.20		J	MS
7440-09-7	Potassium	901.00			MS
7782-49-2	Selenium	0.63	B	J	MS
7440-22-4	Silver	0.56	B	J	MS
7440-23-5	Sodium	397.00	B		MS
7440-28-0	Thallium	0.12	B	J	MS
7440-62-2	Vanadium	19.50			MS
7440-66-6	Zinc	305.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-4-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-4-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 72.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5870.00			MS
7440-36-0	Antimony	3.79	B	J	MS
7440-38-2	Arsenic	14.90			MS
7440-39-3	Barium	667.00			MS
7440-41-7	Beryllium	0.17	B	J	MS
7440-43-9	Cadmium	2.45			MS
7440-70-2	Calcium	91300.00			MS
7440-47-3	Chromium	19.40		J	MS
7440-48-4	Cobalt	4.76			MS
7440-50-8	Copper	102.00			MS
7439-89-6	Iron	9920.00			MS
7439-92-1	Lead	62700.00			MS
7439-95-4	Magnesium	5740.00			MS
7439-96-5	Manganese	1300.00			MS
7439-97-6	Mercury	0.53		J	MS
7440-02-0	Nickel	32.00		J	MS
7440-09-7	Potassium	763.00			MS
7782-49-2	Selenium	0.67	B	J	MS
7440-22-4	Silver	1.31	B	J	MS
7440-23-5	Sodium	477.00	B		MS
7440-28-0	Thallium	0.16	B	J	MS
7440-62-2	Vanadium	12.20			MS
7440-66-6	Zinc	275.00			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-4-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-4-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 52.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1820.00			MS
7440-36-0	Antimony	5.43	B	J	MS
7440-38-2	Arsenic	6.90			MS
7440-39-3	Barium	1150.00			MS
7440-41-7	Beryllium	0.07	B	J	MS
7440-43-9	Cadmium	2.67			MS
7440-70-2	Calcium	175000.00			MS
7440-47-3	Chromium	12.50		J	MS
7440-48-4	Cobalt	2.67			MS
7440-50-8	Copper	109.00			MS
7439-89-6	Iron	6270.00			MS
7439-92-1	Lead	105000.00			MS
7439-95-4	Magnesium	2820.00			MS
7439-96-5	Manganese	2290.00			MS
7439-97-6	Mercury	0.96		J	MS
7440-02-0	Nickel	6.09		J	MS
7440-09-7	Potassium	557.00			MS
7782-49-2	Selenium	0.80	B	J	MS
7440-22-4	Silver	2.05	B	J	MS
7440-23-5	Sodium	394.00	B		MS
7440-28-0	Thallium	0.53	B	J	MS
7440-62-2	Vanadium	2.83			MS
7440-66-6	Zinc	142.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-5-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-5-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 81.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8830.00			MS
7440-36-0	Antimony	4.53	B	J	MS
7440-38-2	Arsenic	7.86			MS
7440-39-3	Barium	360.00			MS
7440-41-7	Beryllium	0.42	B	J	MS
7440-43-9	Cadmium	1.73			MS
7440-70-2	Calcium	49700.00			MS
7440-47-3	Chromium	33.60		J	MS
7440-48-4	Cobalt	11.20			MS
7440-50-8	Copper	317.00			MS
7439-89-6	Iron	17500.00			MS
7439-92-1	Lead	28500.00			MS
7439-95-4	Magnesium	8709.00			MS
7439-96-5	Manganese	850.00			MS
7439-97-6	Mercury	0.53		J	MS
7440-02-0	Nickel	72.90		J	MS
7440-09-7	Potassium	1038.00			MS
7782-49-2	Selenium	0.76	B	J	MS
7440-22-4	Silver	0.84	B	J	MS
7440-23-5	Sodium	370.00	B		MS
7440-28-0	Thallium	0.16	B	J	MS
7440-62-2	Vanadium	22.80			MS
7440-66-6	Zinc	636.00			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-5-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: A-5-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 84.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8260.00			MS
7440-36-0	Antimony	0.46	B	J	MS
7440-38-2	Arsenic	13.40			MS
7440-39-3	Barium	390.00			MS
7440-41-7	Beryllium	0.60		J	MS
7440-43-9	Cadmium	1.17			MS
7440-70-2	Calcium	38700.00			MS
7440-47-3	Chromium	21.60		J	MS
7440-48-4	Cobalt	8.24			MS
7440-50-8	Copper	55.90			MS
7439-89-6	Iron	17500.00			MS
7439-92-1	Lead	3440.00			MS
7439-95-4	Magnesium	4080.00			MS
7439-96-5	Manganese	256.00			MS
7439-97-6	Mercury	0.35		J	MS
7440-02-0	Nickel	26.40		J	MS
7440-09-7	Potassium	1050.00			MS
7782-49-2	Selenium	0.75	B	J	MS
7440-22-4	Silver	0.22	B	J	MS
7440-23-5	Sodium	286.00	B		MS
7440-28-0	Thallium	0.18	B	J	MS
7440-62-2	Vanadium	23.80			MS
7440-66-6	Zinc	417.00			MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

A-5-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: A-5-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 61.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3890.00			MS
7440-36-0	Antimony	10.70		J	MS
7440-38-2	Arsenic	10.40			MS
7440-39-3	Barium	947.00			MS
7440-41-7	Beryllium	0.25	B	J	MS
7440-43-9	Cadmium	2.43			MS
7440-70-2	Calcium	104000.00			MS
7440-47-3	Chromium	12.80		J	MS
7440-48-4	Cobalt	4.16			MS
7440-50-8	Copper	264.00			MS
7439-89-6	Iron	15800.00			MS
7439-92-1	Lead	90900.00			MS
7439-95-4	Magnesium	3020.00			MS
7439-96-5	Manganese	1860.00			MS
7439-97-6	Mercury	0.57		J	MS
7440-02-0	Nickel	22.20		J	MS
7440-09-7	Potassium	699.00			MS
7782-49-2	Selenium	1.28	B	J	MS
7440-22-4	Silver	1.71	B	J	MS
7440-23-5	Sodium	426.00	B		MS
7440-28-0	Thallium	0.29	B	J	MS
7440-62-2	Vanadium	12.20			MS
7440-66-6	Zinc	315.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: B-1-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 86.3

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8270.00			MS
7440-36-0	Antimony	0.52	B	J	MS
7440-38-2	Arsenic	9.71			MS
7440-39-3	Barium	100.00			MS
7440-41-7	Beryllium	0.57		J	MS
7440-43-9	Cadmium	0.40			MS
7440-70-2	Calcium	13400.00			MS
7440-47-3	Chromium	16.30		J	MS
7440-48-4	Cobalt	7.53			MS
7440-50-8	Copper	59.10			MS
7439-89-6	Iron	20400.00			MS
7439-92-1	Lead	8390.00			MS
7439-95-4	Magnesium	4710.00			MS
7439-96-5	Manganese	420.00			MS
7439-97-6	Mercury	0.14		J	MS
7440-02-0	Nickel	22.30		J	MS
7440-09-7	Potassium	939.00			MS
7782-49-2	Selenium	1.39	B	J	MS
7440-22-4	Silver	0.28	B	R	MS
7440-23-5	Sodium	315.00	B		MS
7440-28-0	Thallium	0.38	B	J	MS
7440-62-2	Vanadium	26.30			MS
7440-66-6	Zinc	106.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture:

Color After: Yellow Clarity After: Clear Artifacts:

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

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EPA SAMPLE NO.

B-1-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil Lab Sample ID: B-1-2

Level: (low/med) Low Date Received: 12/18/08

% Solids: 80.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7410.00			MS
7440-36-0	Antimony	2.82	B	J	MS
7440-38-2	Arsenic	47.40			MS
7440-39-3	Barium	290.00			MS
7440-41-7	Beryllium	0.65		J	MS
7440-43-9	Cadmium	1.74			MS
7440-70-2	Calcium	22900.00			MS
7440-47-3	Chromium	30.60		J	MS
7440-48-4	Cobalt	11.40			MS
7440-50-8	Copper	189.00			MS
7439-89-6	Iron	17200.00			MS
7439-92-1	Lead	13400.00			MS
7439-95-4	Magnesium	8029.00			MS
7439-96-5	Manganese	647.00			MS
7439-97-6	Mercury	0.25		J	MS
7440-02-0	Nickel	79.40		J	MS
7440-09-7	Potassium	855.00			MS
7782-49-2	Selenium	1.45	B	J	MS
7440-22-4	Silver	0.95	B	R	MS
7440-23-5	Sodium	441.00	B		MS
7440-28-0	Thallium	0.21	B	J	MS
7440-62-2	Vanadium	37.60			MS
7440-66-6	Zinc	437.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture:

Color After: Yellow Clarity After: Clear Artifacts:

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

B-1-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: B-1-3

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 83.9

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9840.00			MS
7440-36-0	Antimony	0.05	U	J	MS
7440-38-2	Arsenic	4.95			MS
7440-39-3	Barium	60.10			MS
7440-41-7	Beryllium	0.70		J	MS
7440-43-9	Cadmium	0.06			MS
7440-70-2	Calcium	10300.00			MS
7440-47-3	Chromium	30.40		J	MS
7440-48-4	Cobalt	7.50			MS
7440-50-8	Copper	13.00			MS
7439-89-6	Iron	19700.00			MS
7439-92-1	Lead	333.00			MS
7439-95-4	Magnesium	3220.00			MS
7439-96-5	Manganese	280.00			MS
7439-97-6	Mercury	0.09		J	MS
7440-02-0	Nickel	26.90		J	MS
7440-09-7	Potassium	1390.00			MS
7782-49-2	Selenium	0.37	B	J	MS
7440-22-4	Silver	0.07	B	R	MS
7440-23-5	Sodium	393.00	B		MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	36.30			MS
7440-66-6	Zinc	43.80			MS

Color Before: Brown Clarity Before: N/A - Soil Texture:

Color After: Yellow Clarity After: Clear Artifacts:

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

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EPA SAMPLE NO.

B-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: B-2-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 68.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6370.00			MS
7440-36-0	Antimony	0.97	B	J	MS
7440-38-2	Arsenic	2.92			MS
7440-39-3	Barium	815.00			MS
7440-41-7	Beryllium	0.56		J	MS
7440-43-9	Cadmium	1.52			MS
7440-70-2	Calcium	54000.00			MS
7440-47-3	Chromium	108.00		J	MS
7440-48-4	Cobalt	74.60			MS
7440-50-8	Copper	212.00			MS
7439-89-6	Iron	36300.00			MS
7439-92-1	Lead	69300.00			MS
7439-95-4	Magnesium	45100.00			MS
7439-96-5	Manganese	3370.00			MS
7439-97-6	Mercury	1.18		J	MS
7440-02-0	Nickel	1220.00		J	MS
7440-09-7	Potassium	303.00			MS
7782-49-2	Selenium	0.85	B	J	MS
7440-22-4	Silver	1.13	B	R	MS
7440-23-5	Sodium	446.00	B		MS
7440-28-0	Thallium	0.20	B	J	MS
7440-62-2	Vanadium	13.10			MS
7440-66-6	Zinc	184.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture:

Color After: Yellow Clarity After: Clear Artifacts:

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

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EPA SAMPLE NO.

B-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: A-1-1

Matrix: (soil/water) Soil

Lab Sample ID: B-2-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 50.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2330.00			MS
7440-36-0	Antimony	5.53	B	J	MS
7440-38-2	Arsenic	5.21			MS
7440-39-3	Barium	1570.00			MS
7440-41-7	Beryllium	0.15	B	J	MS
7440-43-9	Cadmium	3.76			MS
7440-70-2	Calcium	141000.00			MS
7440-47-3	Chromium	17.70		J	MS
7440-48-4	Cobalt	8.18			MS
7440-50-8	Copper	261.00			MS
7439-89-6	Iron	10050.00			MS
7439-92-1	Lead	145000.00			MS
7439-95-4	Magnesium	14900.00			MS
7439-96-5	Manganese	3300.00			MS
7439-97-6	Mercury	1.35		J	MS
7440-02-0	Nickel	118.00		J	MS
7440-09-7	Potassium	337.00			MS
7782-49-2	Selenium	1.70	B	J	MS
7440-22-4	Silver	2.34	B	R	MS
7440-23-5	Sodium	682.00			MS
7440-28-0	Thallium	0.24	B	J	MS
7440-62-2	Vanadium	5.58			MS
7440-66-6	Zinc	191.00			MS

Color Before: Brown Clarity Before: N/A - Soil Texture:

Color After: Yellow Clarity After: Clear Artifacts:

B - Detected value < the Contract Required Detection Limit (CRDL)
 U - Undetected value < the Instrument Detection Limit (IDL)
 J - Estimated concentration due to data validation criteria.
 R - Rejected Value

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

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Date: Jan 1992
Number: HW2
Revision: 11

Case# <u>Jewett1</u>	Site <u>Jewett Lead</u>	Matrix Soil: <u>20</u>
SDG# <u>A-1-1</u>	Lab <u>U.S. EPA Region 2 Mobile Lab</u>	Water: <u>00</u>
Contractor <u>Not Applicable</u>	Reviewer <u>Robert Finke</u>	Other: <u>00</u>

A.2.1 Validation Flags- The following flags have been applied in red by the data validator
Which must be considered by the data user.

- J - This flag indicates that a result is qualified as estimated.
- UJ - This flag indicates that the analyte was analyzed but not detected
And is to be considered as estimated because it may be inaccurate
or imprecise.
- R - This flag indicates that the sample result is to be considered
unusable due to significant error and must not be used by the data
user.

Fully Usable Data - Results which carry a "J" or "UJ" are considered to be fully usable.

Contractual Qualifiers - The legend of the contractual qualifiers applied by the laboratory
On the Form I's are found on page B-20 of SOW ILM04.0.

A.2.2 The data assessment is given below and on the attached data sheets

This SDG (A-1-1) consists of 20 soil samples collected on December 18, 2008 from the Jewett Lead Superfund site on Staten Island, NY. The samples were prepared on December 23, 200 and analyzed on January 23, 2009 by the U.S. EPA Region 2 Mobile Analytical Laboratory for the 22 routine Target Analyte List (TAL) metals and mercury with full Contract Laboratory Program (CLP) Quality Control (QC). This analysis was conducted according to SOP MAL-3.07A which is based upon U.S. EPA CLP SOW ILM04.0, SW-846 Method 6010A, and the U.S. EPA Region 2 DESA Laboratory protocol. Upon completion of this analysis and compiling the results, a formal validation was performed to assure the data contained in this analytical report are of appropriate quality. This being performed as part of the requirements of the Quality Assurance (QA) program put forth for the U.S. EPA Region 2 Mobile Analytical Laboratory to ensure its proper operation. This review and evaluation was carried out according to the U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

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Date: Jan 1992

Number: HW2

Revision: 11

And U.S. EPA Region 2 Data Validation SOP *Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW. 3/90, Rev. XI.* It applies to a systematic approach for examining analytical results to identify and assess the indication of bias to render an overall determination of data usability. In doing so, the data user is assured as to how well a given set of analytical results will conform to the established environmental monitoring performance criteria defined for their project. In accordance, the following qualifications are applied to this data set which must be considered when utilizing these results to make sound environmental decisions.

1. Calibration

The results of an Initial Calibration Verification (ICV) determination yielded a recovery which was not within the specified control limits of 90 - 110%R. This requires that the associated results be qualified as estimated "J" or rejected "R" in the affected environmental samples resulting in the following required action(s.)

Element	%R	Qualification	Sample(s) Qualified
Silver	55.5	R	A-1-1, A-1-2

The results of an Continuing Calibration Verification (CCV) determination yielded recoveries which were not within the specified control limits of 90-110%R. This requires that the associated results be qualified as estimated "J" in the affected environmental samples, resulting in the following required action(s.)

Element	%R	Qualification	Sample(s) Qualified
Nickel (CCV-1)	88.3	J	A-1-1, A-1-2, A-1-3, A-2-1, A-2-2, A-2-3, A-3-1, A-3-2
Nickel (CCV-2)	87.1	J	A-4-1, A-4-2, A-4-3, A-5-1, A-5-2, A-5-3, B-1-1, B-1-2, B-1-3
All Elements*		J	B-2-2, B-2-1, B-1-3, B-1-2, B-1-1

* A CCV-3 was not analyzed, therefore, all elements in the last five samples have been qualified estimated "J"

2. Laboratory Control Sample

The Laboratory Control Sample (LCS) "found" value for **silver** was greater than the upper acceptable range and has therefore been qualified estimated "J" in all samples contained in this SDG. The Laboratory Control Sample (LCS) "found" value for **beryllium and nickel** were lower than the lower acceptable range and have therefore been qualified estimated "J" in all samples contained in this samples contained in this SDG.

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
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Appendix A.2: Data Assessment Narrative

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3. Matrix Spike

The matrix spike recovery of **silver** was greater than 125% but less than 200 percent. Therefore, all positive (not flagged with a "U") silver data not previously qualified has been qualified estimated "J".

4. Serial Dilution

The serial dilution result was greater than 10 percent different than the non-diluted sample for **chromium, selenium, antimony, mercury, and thallium**. All results for these elements were greater than ten times the IDL and have therefore been qualified estimated "J" in all samples contained in this SDG.

5.

Percent Solids

Samples A-2-2 and A-2-3 possessed less than 50% solids. All elements in those samples have therefore been qualified estimated "J".

U.S. EPA

COVER PAGE

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: MODSW846 6020ALab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3SOW No.: N/A

<u>EPA Sample No.</u>	<u>Lab Sample ID</u>
B-2-3	B-2-3
B-3-1	B-3-1
B-3-2	B-3-2
B-3-3	B-3-3
B-4-1	B-4-1
B-4-2	B-4-2
B-4-3	B-4-3
B-4-3 (D)	B-4-3 (D)
B-4-3 (S)	B-4-3 (S)
B-4-3 (L)	B-4-3 (L)
C-1-1	C-1-1
C-1-2	C-1-2
C-1-3	C-1-3
C-2-1	C-2-1
C-2-2	C-2-2
C-2-3	C-2-3
C-3-1	C-3-1
C-3-3	C-3-3
D-1-1	D-1-1
D-1-2	D-1-2
D-1-3	D-1-3
D-2-1	D-2-1

		ICP-AES	ICP-MS
Were ICP-AES and ICP-MS interelement corrections applied?	(Yes/No)	_____	<u>No</u>
Were ICP-AES and ICP-MS background corrections applied?	(Yes/No)	_____	<u>No</u>
If yes, were raw data generated before application of background corrections?	(Yes/No)	_____	<u>No</u>

Comments:

(D) = laboratory matrix duplicate sample, (S) = laboratory matrix spike sample (L) = Serial Dilution sample

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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-2-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: B-2-3

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 43.2

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2020.00		J	MS
7440-36-0	Antimony	5.47	B	J	MS
7440-38-2	Arsenic	3.48		J	MS
7440-39-3	Barium	1250.00		J	MS
7440-41-7	Beryllium	0.26	B	J	MS
7440-43-9	Cadmium	4.18		J	MS
7440-70-2	Calcium	227000.00		J	MS
7440-47-3	Chromium	20.40		J	MS
7440-48-4	Cobalt	4660.00		J	MS
7440-50-8	Copper	127.00		J	MS
7439-89-6	Iron	6790.00		J	MS
7439-92-1	Lead	160000.00		J	MS
7439-95-4	Magnesium	9960.00		J	MS
7439-96-5	Manganese	4380.00		J	MS
7439-97-6	Mercury	1.18		J	MS
7440-02-0	Nickel	91.60		J	MS
7440-09-7	Potassium	276.00		J	MS
7782-49-2	Selenium	0.89	B	J	MS
7440-22-4	Silver	3.83	B	J	MS
7440-23-5	Sodium	739.00		J	MS
7440-28-0	Thallium	0.62	B	J	MS
7440-62-2	Vanadium	4.53		J	MS
7440-66-6	Zinc	206.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-3-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: B-3-1

Level: (low/med) Low Date Received: 12/18/08

% Solids: 86.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7110.00		J	MS
7440-36-0	Antimony	1.07	B	J	MS
7440-38-2	Arsenic	6.80		J	MS
7440-39-3	Barium	207.00			MS
7440-41-7	Beryllium	0.50	B	J	MS
7440-43-9	Cadmium	1.20		J	MS
7440-70-2	Calcium	53080.00			MS
7440-47-3	Chromium	26.20			MS
7440-48-4	Cobalt	7.88			MS
7440-50-8	Copper	80.40		J	MS
7439-89-6	Iron	13600.00			MS
7439-92-1	Lead	10300.00		J	MS
7439-95-4	Magnesium	17600.00			MS
7439-96-5	Manganese	448.00		J	MS
7439-97-6	Mercury	0.65			MS
7440-02-0	Nickel	113.00		J	MS
7440-09-7	Potassium	873.00			MS
7782-49-2	Selenium	0.72	B		MS
7440-22-4	Silver	0.46	B	J	MS
7440-23-5	Sodium	430.00	B	J	MS
7440-28-0	Thallium	0.22	B	J	MS
7440-62-2	Vanadium	20.20		J	MS
7440-66-6	Zinc	322.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-3-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: B-3-2

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 56.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4740.00		J	MS
7440-36-0	Antimony	6.24	B	J	MS
7440-38-2	Arsenic	6.79		J	MS
7440-39-3	Barium	1480.00			MS
7440-41-7	Beryllium	0.52		J	MS
7440-43-9	Cadmium	3.71		J	MS
7440-70-2	Calcium	150000.00			MS
7440-47-3	Chromium	28.60			MS
7440-48-4	Cobalt	16.00			MS
7440-50-8	Copper	160.00		J	MS
7439-89-6	Iron	16400.00			MS
7439-92-1	Lead	123000.00		J	MS
7439-95-4	Magnesium	13600.00			MS
7439-96-5	Manganese	4020.00		J	MS
7439-97-6	Mercury	0.84			MS
7440-02-0	Nickel	490.00		J	MS
7440-09-7	Potassium	589.00			MS
7782-49-2	Selenium	1.37	B		MS
7440-22-4	Silver	4.17	B	J	MS
7440-23-5	Sodium	690.00		J	MS
7440-28-0	Thallium	0.60	B	J	MS
7440-62-2	Vanadium	11.80		J	MS
7440-66-6	Zinc	243.00		J	MS

Color Before: Brown

Clarity Before: N/A - Soil Texture: _____

Color After: Yellow

Clarity After: Clear

Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-3-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: B-3-3

Level: (low/med) Low Date Received: 12/18/08

% Solids: 61.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5470.00		J	MS
7440-36-0	Antimony	7.00		J	MS
7440-38-2	Arsenic	15.00		J	MS
7440-39-3	Barium	1280.00			MS
7440-41-7	Beryllium	1.16		J	MS
7440-43-9	Cadmium	2.76		J	MS
7440-70-2	Calcium	171000.00			MS
7440-47-3	Chromium	22.80			MS
7440-48-4	Cobalt	6.48			MS
7440-50-8	Copper	245.00		J	MS
7439-89-6	Iron	11900.00			MS
7439-92-1	Lead	100700.00		J	MS
7439-95-4	Magnesium	6090.00			MS
7439-96-5	Manganese	7900.00		J	MS
7439-97-6	Mercury	1.42			MS
7440-02-0	Nickel	302.00		J	MS
7440-09-7	Potassium	735.00			MS
7782-49-2	Selenium	2.02	B		MS
7440-22-4	Silver	3.03	B	J	MS
7440-23-5	Sodium	921.00		J	MS
7440-28-0	Thallium	0.31	B	J	MS
7440-62-2	Vanadium	7.71		J	MS
7440-66-6	Zinc	180.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)
U - Undetected value < the Instrument Detection Limit (IDL)
J - Estimated concentration due to data validation criteria.
R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-4-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: B-4-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 84.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7042.00		J	MS
7440-36-0	Antimony	1.37	B	J	MS
7440-38-2	Arsenic	5.31		J	MS
7440-39-3	Barium	236.00			MS
7440-41-7	Beryllium	0.45	B	J	MS
7440-43-9	Cadmium	1.41		J	MS
7440-70-2	Calcium	49900.00			MS
7440-47-3	Chromium	15.20			MS
7440-48-4	Cobalt	5.61			MS
7440-50-8	Copper	94.60		J	MS
7439-89-6	Iron	12500.00			MS
7439-92-1	Lead	17300.00		J	MS
7439-95-4	Magnesium	8940.00			MS
7439-96-5	Manganese	505.00		J	MS
7439-97-6	Mercury	0.46			MS
7440-02-0	Nickel	43.90		J	MS
7440-09-7	Potassium	1980.00			MS
7782-49-2	Selenium	0.23	B		MS
7440-22-4	Silver	0.56	B	J	MS
7440-23-5	Sodium	410.00	B	J	MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	18.90		J	MS
7440-66-6	Zinc	376.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-4-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: B-4-2

Level: (low/med) Low Date Received: 12/18/08

% Solids: 72.6

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7550.00		J	MS
7440-36-0	Antimony	0.77	B	J	MS
7440-38-2	Arsenic	6.27		J	MS
7440-39-3	Barium	181.00			MS
7440-41-7	Beryllium	0.51		J	MS
7440-43-9	Cadmium	2.25		J	MS
7440-70-2	Calcium	81100.00			MS
7440-47-3	Chromium	22.40			MS
7440-48-4	Cobalt	5.46			MS
7440-50-8	Copper	118.00		J	MS
7439-89-6	Iron	12700.00			MS
7439-92-1	Lead	8870.00		J	MS
7439-95-4	Magnesium	8840.00			MS
7439-96-5	Manganese	365.00		J	MS
7439-97-6	Mercury	0.55			MS
7440-02-0	Nickel	41.50		J	MS
7440-09-7	Potassium	1020.00			MS
7782-49-2	Selenium	0.20	B		MS
7440-22-4	Silver	0.33	B	J	MS
7440-23-5	Sodium	440.00	B	J	MS
7440-28-0	Thallium	0.11	B	J	MS
7440-62-2	Vanadium	21.20		J	MS
7440-66-6	Zinc	560.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
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INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

B-4-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: B-4-3

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 74.9

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6880.00		J	MS
7440-36-0	Antimony	1.09	B	J	MS
7440-38-2	Arsenic	4.69		J	MS
7440-39-3	Barium	236.00			MS
7440-41-7	Beryllium	0.40	B	J	MS
7440-43-9	Cadmium	1.82		J	MS
7440-70-2	Calcium	75500.00			MS
7440-47-3	Chromium	35.00			MS
7440-48-4	Cobalt	5.10			MS
7440-50-8	Copper	94.00		J	MS
7439-89-6	Iron	13600.00			MS
7439-92-1	Lead	18400.00		J	MS
7439-95-4	Magnesium	5820.00			MS
7439-96-5	Manganese	503.00		J	MS
7439-97-6	Mercury	0.67			MS
7440-02-0	Nickel	57.60		J	MS
7440-09-7	Potassium	1150.00			MS
7782-49-2	Selenium	1.13	B		MS
7440-22-4	Silver	0.48	B	J	MS
7440-23-5	Sodium	575.00		J	MS
7440-28-0	Thallium	0.49	B	J	MS
7440-62-2	Vanadium	19.00		J	MS
7440-66-6	Zinc	408.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-1-1

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 83.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5670.00		J	MS
7440-36-0	Antimony	2.31	B	J	MS
7440-38-2	Arsenic	9.55		J	MS
7440-39-3	Barium	205.00			MS
7440-41-7	Beryllium	0.42	B	J	MS
7440-43-9	Cadmium	0.84		J	MS
7440-70-2	Calcium	66200.00			MS
7440-47-3	Chromium	14.40			MS
7440-48-4	Cobalt	7.17			MS
7440-50-8	Copper	146.00		J	MS
7439-89-6	Iron	14600.00			MS
7439-92-1	Lead	12500.00		J	MS
7439-95-4	Magnesium	30900.00			MS
7439-96-5	Manganese	498.00		J	MS
7439-97-6	Mercury	0.24			MS
7440-02-0	Nickel	55.34		J	MS
7440-09-7	Potassium	650.00			MS
7782-49-2	Selenium	0.41	B		MS
7440-22-4	Silver	0.50	B	J	MS
7440-23-5	Sodium	293.00	B	J	MS
7440-28-0	Thallium	0.15	B	J	MS
7440-62-2	Vanadium	20.70		J	MS
7440-66-6	Zinc	234.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-1-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: C-1-2

Level: (low/med) Low Date Received: 12/17/08

% Solids: 72.4

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8050.00		J	MS
7440-36-0	Antimony	7.15		J	MS
7440-38-2	Arsenic	9.54		J	MS
7440-39-3	Barium	457.00			MS
7440-41-7	Beryllium	0.58		J	MS
7440-43-9	Cadmium	1.93		J	MS
7440-70-2	Calcium	43600.00			MS
7440-47-3	Chromium	21.10			MS
7440-48-4	Cobalt	7.18			MS
7440-50-8	Copper	1480.00		J	MS
7439-89-6	Iron	28900.00			MS
7439-92-1	Lead	31300.00		J	MS
7439-95-4	Magnesium	4130.00			MS
7439-96-5	Manganese	847.00		J	MS
7439-97-6	Mercury	0.31			MS
7440-02-0	Nickel	43.10		J	MS
7440-09-7	Potassium	780.00			MS
7782-49-2	Selenium	0.73	B		MS
7440-22-4	Silver	0.98	B	J	MS
7440-23-5	Sodium	278.00	B	J	MS
7440-28-0	Thallium	0.20	B	J	MS
7440-62-2	Vanadium	25.90		J	MS
7440-66-6	Zinc	3200.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-1-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-1-3

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 70.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9880.00		J	MS
7440-36-0	Antimony	9.44		J	MS
7440-38-2	Arsenic	6.04		J	MS
7440-39-3	Barium	527.00			MS
7440-41-7	Beryllium	0.70		J	MS
7440-43-9	Cadmium	1.77		J	MS
7440-70-2	Calcium	40100.00			MS
7440-47-3	Chromium	17.40			MS
7440-48-4	Cobalt	8.39			MS
7440-50-8	Copper	981.00		J	MS
7439-89-6	Iron	22600.00			MS
7439-92-1	Lead	38000.00		J	MS
7439-95-4	Magnesium	4290.00			MS
7439-96-5	Manganese	946.00		J	MS
7439-97-6	Mercury	0.26			MS
7440-02-0	Nickel	53.30		J	MS
7440-09-7	Potassium	1038.00			MS
7782-49-2	Selenium	0.70	B		MS
7440-22-4	Silver	1.04	B	J	MS
7440-23-5	Sodium	314.00	B	J	MS
7440-28-0	Thallium	0.20	B	J	MS
7440-62-2	Vanadium	23.60		J	MS
7440-66-6	Zinc	2090.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-2-1

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 46.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3230.00		J	MS
7440-36-0	Antimony	13.30		J	MS
7440-38-2	Arsenic	8.69		J	MS
7440-39-3	Barium	1610.00		J	MS
7440-41-7	Beryllium	0.42	B	J	MS
7440-43-9	Cadmium	4.80		J	MS
7440-70-2	Calcium	18800.00		J	MS
7440-47-3	Chromium	19.20		J	MS
7440-48-4	Cobalt	5.06		J	MS
7440-50-8	Copper	1130.00		J	MS
7439-89-6	Iron	17300.00		J	MS
7439-92-1	Lead	148000.00		J	MS
7439-95-4	Magnesium	5020.00		J	MS
7439-96-5	Manganese	3720.00		J	MS
7439-97-6	Mercury	0.79		J	MS
7440-02-0	Nickel	86.60		J	MS
7440-09-7	Potassium	516.00		J	MS
7782-49-2	Selenium	1.12	B	J	MS
7440-22-4	Silver	7.74	B	J	MS
7440-23-5	Sodium	823.00		J	MS
7440-28-0	Thallium	0.44	B	J	MS
7440-62-2	Vanadium	10.50		J	MS
7440-66-6	Zinc	227.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-2-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-2-2

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 50.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1880.00		J	MS
7440-36-0	Antimony	8.47		J	MS
7440-38-2	Arsenic	5.72		J	MS
7440-39-3	Barium	1550.00			MS
7440-41-7	Beryllium	0.25	B	J	MS
7440-43-9	Cadmium	5.46		J	MS
7440-70-2	Calcium	192000.00			MS
7440-47-3	Chromium	21.50			MS
7440-48-4	Cobalt	4.42			MS
7440-50-8	Copper	145.00		J	MS
7439-89-6	Iron	7600.00			MS
7439-92-1	Lead	136000.00		J	MS
7439-95-4	Magnesium	2960.00			MS
7439-96-5	Manganese	4120.00		J	MS
7439-97-6	Mercury	0.42			MS
7440-02-0	Nickel	188.00		J	MS
7440-09-7	Potassium	332.00			MS
7782-49-2	Selenium	0.78	B		MS
7440-22-4	Silver	4.54	B	J	MS
7440-23-5	Sodium	618.00		J	MS
7440-28-0	Thallium	062	B	J	MS
7440-62-2	Vanadium	3.78		J	MS
7440-66-6	Zinc	230.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-2-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-2-3

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 49.8

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1809.00		J	MS
7440-36-0	Antimony	9.08		J	MS
7440-38-2	Arsenic	5.90		J	MS
7440-39-3	Barium	1580.00		J	MS
7440-41-7	Beryllium	0.26	B	J	MS
7440-43-9	Cadmium	5.21		J	MS
7440-70-2	Calcium	282000.00		J	MS
7440-47-3	Chromium	13.90		J	MS
7440-48-4	Cobalt	3.87		J	MS
7440-50-8	Copper	153.00		J	MS
7439-89-6	Iron	6300.00		J	MS
7439-92-1	Lead	134000.00		J	MS
7439-95-4	Magnesium	4180.00		J	MS
7439-96-5	Manganese	4660.00		J	MS
7439-97-6	Mercury	0.84		J	MS
7440-02-0	Nickel	54.60		J	MS
7440-09-7	Potassium	437.00		J	MS
7782-49-2	Selenium	0.79	B	J	MS
7440-22-4	Silver	4.51	B	J	MS
7440-23-5	Sodium	837.00		J	MS
7440-28-0	Thallium	0.75	B	J	MS
7440-62-2	Vanadium	3.93		J	MS
7440-66-6	Zinc	206.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-3-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-3-1

Level: (low/med) Low

Date Received: 12/18/08

% Solids: 80.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7980.00		J	MS
7440-36-0	Antimony	0.95	B	J	MS
7440-38-2	Arsenic	33.40		J	MS
7440-39-3	Barium	230.00			MS
7440-41-7	Beryllium	0.66		J	MS
7440-43-9	Cadmium	1.17		J	MS
7440-70-2	Calcium	6280.00			MS
7440-47-3	Chromium	14.70			MS
7440-48-4	Cobalt	5.29			MS
7440-50-8	Copper	64.29		J	MS
7439-89-6	Iron	10060.00			MS
7439-92-1	Lead	12800.00		J	MS
7439-95-4	Magnesium	8400.00			MS
7439-96-5	Manganese	423.00		J	MS
7439-97-6	Mercury	0.33			MS
7440-02-0	Nickel	31.50		J	MS
7440-09-7	Potassium	1390.00			MS
7782-49-2	Selenium	0.92	B		MS
7440-22-4	Silver	0.52	B	J	MS
7440-23-5	Sodium	444.00	B	J	MS
7440-28-0	Thallium	0.23	B	J	MS
7440-62-2	Vanadium	26.00		J	MS
7440-66-6	Zinc	257.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

C-3-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: C-3-3

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 43.1

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1801.00		J	MS
7440-36-0	Antimony	8.42		J	MS
7440-38-2	Arsenic	6.26		J	MS
7440-39-3	Barium	1690.00		J	MS
7440-41-7	Beryllium	0.27	B	J	MS
7440-43-9	Cadmium	4.50		J	MS
7440-70-2	Calcium	24600.00		J	MS
7440-47-3	Chromium	17.50		J	MS
7440-48-4	Cobalt	3.69		J	MS
7440-50-8	Copper	140.00		J	MS
7439-89-6	Iron	6720.00		J	MS
7439-92-1	Lead	147000.00		J	MS
7439-95-4	Magnesium	3800.00		J	MS
7439-96-5	Manganese	3760.00		J	MS
7439-97-6	Mercury	0.53		J	MS
7440-02-0	Nickel	57.10		J	MS
7440-09-7	Potassium	740.00		J	MS
7782-49-2	Selenium	1.10	B	J	MS
7440-22-4	Silver	3.27	B	J	MS
7440-23-5	Sodium	727.00		J	MS
7440-28-0	Thallium	0.77	B	J	MS
7440-62-2	Vanadium	3.97		J	MS
7440-66-6	Zinc	196.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-1-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: D-1-1

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 83.9

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5420.00		J	MS
7440-36-0	Antimony	1.41	B	J	MS
7440-38-2	Arsenic	7.87		J	MS
7440-39-3	Barium	159.00			MS
7440-41-7	Beryllium	0.49	B	J	MS
7440-43-9	Cadmium	1.66		J	MS
7440-70-2	Calcium	35800.00			MS
7440-47-3	Chromium	15.10			MS
7440-48-4	Cobalt	5.77			MS
7440-50-8	Copper	315.00		J	MS
7439-89-6	Iron	11200.00			MS
7439-92-1	Lead	1520.00		J	MS
7439-95-4	Magnesium	4840.00			MS
7439-96-5	Manganese	240.00		J	MS
7439-97-6	Mercury	0.47			MS
7440-02-0	Nickel	27.40		J	MS
7440-09-7	Potassium	752.00			MS
7782-49-2	Selenium	0.24	B		MS
7440-22-4	Silver	0.51	B	J	MS
7440-23-5	Sodium	212.00	B	J	MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	23.60		J	MS
7440-66-6	Zinc	590.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-1-2

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil

Lab Sample ID: D-1-2

Level: (low/med) Low

Date Received: 12/17/08

% Solids: 88.0

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5420.00		J	MS
7440-36-0	Antimony	1.41	B	J	MS
7440-38-2	Arsenic	7.87		J	MS
7440-39-3	Barium	159.00			MS
7440-41-7	Beryllium	0.49	B	J	MS
7440-43-9	Cadmium	1.66		J	MS
7440-70-2	Calcium	35800.00			MS
7440-47-3	Chromium	15.10			MS
7440-48-4	Cobalt	5.77			MS
7440-50-8	Copper	315.00		J	MS
7439-89-6	Iron	11200.00			MS
7439-92-1	Lead	1520.00		J	MS
7439-95-4	Magnesium	4840.00			MS
7439-96-5	Manganese	240.00		J	MS
7439-97-6	Mercury	0.47			MS
7440-02-0	Nickel	27.40		J	MS
7440-09-7	Potassium	752.00			MS
7782-49-2	Selenium	0.24	B		MS
7440-22-4	Silver	0.51	B	J	MS
7440-23-5	Sodium	212.00	B	J	MS
7440-28-0	Thallium	0.13	B	J	MS
7440-62-2	Vanadium	23.60		J	MS
7440-66-6	Zinc	590.00		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-1-3

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: D-1-3

Level: (low/med) Low Date Received: 12/17/08

% Solids: 86.5

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7170.00		J	MS
7440-36-0	Antimony	0.01	U	J	MS
7440-38-2	Arsenic	4.54		J	MS
7440-39-3	Barium	26.60			MS
7440-41-7	Beryllium	0.42	B	J	MS
7440-43-9	Cadmium	0.02		J	MS
7440-70-2	Calcium	1071.00			MS
7440-47-3	Chromium	36.90			MS
7440-48-4	Cobalt	5.55			MS
7440-50-8	Copper	9.33		J	MS
7439-89-6	Iron	18700.00			MS
7439-92-1	Lead	16.20		J	MS
7439-95-4	Magnesium	1940.00			MS
7439-96-5	Manganese	112.00		J	MS
7439-97-6	Mercury	0.06			MS
7440-02-0	Nickel	41.00		J	MS
7440-09-7	Potassium	658.00			MS
7782-49-2	Selenium	0.03	U		MS
7440-22-4	Silver	0.02	B	J	MS
7440-23-5	Sodium	37.10	B	J	MS
7440-28-0	Thallium	0.08	B	J	MS
7440-62-2	Vanadium	22.80		J	MS
7440-66-6	Zinc	29.90		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria

R - Rejected Value

U.S. EPA
1A-IN
INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.

D-2-1

Lab Name: U.S. EPA Region 2 Mobile Analytical Laboratory Method: SW846 6020A

Lab Code: R2-MAL Case No.: Jewett1 NRAS No.: _____ SDG No.: B-2-3

Matrix: (soil/water) Soil Lab Sample ID: D-2-1

Level: (low/med) Low Date Received: 12/17/08

% Solids: 85.7

Concentration Units ($\mu\text{g/L}$ or mg/kg dry weight): mg/kg

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8804.00		J	MS
7440-36-0	Antimony	0.04	B	J	MS
7440-38-2	Arsenic	9.04		J	MS
7440-39-3	Barium	112.00			MS
7440-41-7	Beryllium	0.73		J	MS
7440-43-9	Cadmium	0.08		J	MS
7440-70-2	Calcium	13300.00			MS
7440-47-3	Chromium	25.40			MS
7440-48-4	Cobalt	6.92			MS
7440-50-8	Copper	22.80		J	MS
7439-89-6	Iron	17300.00			MS
7439-92-1	Lead	425.00		J	MS
7439-95-4	Magnesium	3150.00			MS
7439-96-5	Manganese	422.00		J	MS
7439-97-6	Mercury	0.82			MS
7440-02-0	Nickel	27.20		J	MS
7440-09-7	Potassium	764.00			MS
7782-49-2	Selenium	0.17	B		MS
7440-22-4	Silver	0.26	B	J	MS
7440-23-5	Sodium	130.00	B	J	MS
7440-28-0	Thallium	0.10	B	J	MS
7440-62-2	Vanadium	22.00		J	MS
7440-66-6	Zinc	64.50		J	MS

Color Before: Brown Clarity Before: N/A - Soil Texture: _____

Color After: Yellow Clarity After: Clear Artifacts: _____

B - Detected value < the Contract Required Detection Limit (CRDL)

U - Undetected value < the Instrument Detection Limit (IDL)

J - Estimated concentration due to data validation criteria.

R - Rejected Value

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

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Date: Jan 1992
Number: HW2
Revision: 11

Case# <u>Jewett1</u>	Site <u>Jewett Lead</u>	Matrix Soil: <u>19</u>
SDG# <u>B-2-3</u>	Lab <u>U.S. EPA Region 2 Mobile Lab</u>	Water: <u>00</u>
Contractor <u>Not Applicable</u>	Reviewer <u>Robert Finke</u>	Other: <u>00</u>

A.2.1 Validation Flags- The following flags have been applied in red by the data validator
Which must be considered by the data user.

- J - This flag indicates that a result is qualified as estimated.
- UJ - This flag indicates that the analyte was analyzed but not detected
And is to be considered as estimated because it may be inaccurate
or imprecise.
- R - This flag indicates that the sample result is to be considered
unusable due to significant error and must not be used by the data
user.

Fully Usable Data - Results which carry a "J" or "UJ" are considered to be fully usable.

Contractual Qualifiers - The legend of the contractual qualifiers applied by the laboratory
On the Form I's are found on page B-20 of SOW ILM04.0.

A.2.2 The data assessment is given below and on the attached data sheets

This SDG (B-2-3) consists of 19 soil samples collected on December 18, 2008 from the Jewett Lead Superfund site on Staten Island, NY. The samples were prepared on December 23, 200 and analyzed on January 23, 2009 by the U.S. EPA Region 2 Mobile Analytical Laboratory for the 22 routine Target Analyte List (TAL) metals and mercury with full Contract Laboratory Program (CLP) Quality Control (QC). This analysis was conducted according to SOP MAL-3.07A which is based upon U.S. EPA CLP SOW ILM04.0, SW-846 Method 6010A, and the U.S. EPA Region 2 DESA Laboratory protocol. Upon completion of this analysis and compiling the results, a formal validation was performed to assure the data contained in this analytical report are of appropriate quality. This being performed as part of the requirements of the Quality Assurance (QA) program put forth for the U.S. EPA Region 2 Mobile Analytical Laboratory to ensure its proper operation. This review and evaluation was carried out according to the U.S. EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review

STANDARD OPERATING PROCEDURE

Title: Evaluation of Metals data for the
Contract Laboratory Program
Appendix A.2: Data Assessment Narrative

Page 28 of 34
Date: Jan 1992
Number: HW2
Revision: 11

And U.S. EPA Region 2 Data Validation SOP *Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW. 3/90, Rev. XI.* It applies to a systematic approach for examining analytical results to identify and assess the indication of bias to render an overall determination of data usability. In doing so, the data user is assured as to how well a given set of analytical results will conform to the established environmental monitoring performance criteria defined for their project. In accordance, the following qualifications are applied to this data set which must be considered when utilizing these results to make sound environmental decisions.

1. Laboratory Control Sample

The Laboratory Control Sample (LCS) "found" value for **nickel, and lead** were greater than the upper acceptable range and have therefore been qualified estimated "J" in all samples contained in this SDG. The Laboratory Control Sample (LCS) "found" value for **arsenic and zinc** were lower than the lower acceptable range and have therefore been qualified estimated "J" in all samples contained in this samples contained in this SDG.

2. Matrix Spike

The matrix spike recovery of **antimony** was between 10-74%. Therefore, all antimony data contained in this SDG has been qualified estimated "J".

3. Serial Dilution

The serial dilution result was greater than 10 percent different than the non-diluted sample for **beryllium, sodium, aluminum, vanadium, manganese, nickel, copper, zinc, silver, cadmium, antimony, and thallium.** All results for these elements were greater than ten times the IDL and have therefore been qualified estimated "J" in all samples contained in this SDG.

4.

Percent Solids

Samples B-2-3, C-2-1, C-2-3, C-3-2, and C-3-3, possessed less than 50% solids. All elements in those samples have therefore been qualified estimated "J"



U.S. Environmental Protection Agency
Region 2 Laboratory
2890 Woodbridge Avenue
Edison, NJ 08837

Data Report: JEWETT WHITE LEAD

Project Number: 08120050

Program: Y206E

Project Leader: MICHAEL A. MERCADO

Remark Codes	Explanation
U	THE ANALYTE WAS NOT DETECTED AT OR ABOVE THE REPORTING LIMIT.
J	THE IDENTIFICATION OF THE ANALYTE IS ACCEPTABLE; THE REPORTED VALUE IS AN ESTIMATE.
UJ	THE ANALYTE WAS NOT DETECTED AT OR ABOVE THE REPORTING LIMIT. THE REPORTING LIMIT IS AN ESTIMATE.
N	THERE IS PRESUMPTIVE EVIDENCE THAT THE ANALYTE IS PRESENT; THE ANALYTE IS REPORTED AS A TENTATIVE IDENTIFICATION.
NJ	THERE IS PRESUMPTIVE EVIDENCE THAT THE ANALYTE IS PRESENT; THE ANALYTE IS REPORTED AS A TENTATIVE IDENTIFICATION. THE REPORTED VALUE IS AN ESTIMATE.
R	THE PRESENCE OR ABSENCE OF THE ANALYTE CANNOT BE DETERMINED FROM THE DATA DUE TO SEVERE QUALITY CONTROL PROBLEMS. THE DATA ARE REJECTED AND CONSIDERED UNUSABLE.
K	THE IDENTIFICATION OF THE ANALYTE IS ACCEPTABLE; THE REPORTED VALUE MAY BE BIASED HIGH. THE ACTUAL VALUE IS EXPECTED TO BE LESS THAN THE REPORTED VALUE.
L	THE IDENTIFICATION OF THE ANALYTE IS ACCEPTABLE; THE REPORTED VALUE MAY BE BIASED LOW. THE ACTUAL VALUE IS EXPECTED TO BE GREATER THAN THE REPORTED VALUE.
NV	NOT VALIDATED
INC	RESULT NOT ENTERED



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06189

Field/Station ID: RB-01

Date Received: 12/18/2008

Matrix: Aqueous

Sample Description: RINSATE

Analysis Type: PCBS TCL GC SOM1.1 AQUEOUS

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	0.031U	ug/L
11104-28-2	AROCLOR 1221	---	0.063U	ug/L
11141-16-5	AROCLOR 1232	---	0.031U	ug/L
53469-21-9	AROCLOR 1242	---	0.031U	ug/L
12672-29-6	AROCLOR 1248	---	0.031U	ug/L
11097-69-1	AROCLOR 1254	---	0.031U	ug/L
11096-82-5	AROCLOR 1260	---	0.031U	ug/L
37324-23-5	AROCLOR 1262	---	0.031U	ug/L
11100-14-4	AROCLOR 1268	---	0.031U	ug/L

AK06190

Field/Station ID: C-1-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	89U	ug/Kg
11104-28-2	AROCLOR 1221	---	89U	ug/Kg
11141-16-5	AROCLOR 1232	---	89U	ug/Kg
53469-21-9	AROCLOR 1242	---	89U	ug/Kg
12672-29-6	AROCLOR 1248	---	89U	ug/Kg
11097-69-1	AROCLOR 1254	---	89U	ug/Kg
11096-82-5	AROCLOR 1260	---	89U	ug/Kg
37324-23-5	AROCLOR 1262	---	89U	ug/Kg
11100-14-4	AROCLOR 1268	---	89U	ug/Kg

AK06191

Field/Station ID: C-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06191

Field/Station ID: C-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

AK06192

Field/Station ID: D-1-1

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	72U	ug/Kg
11104-28-2	AROCLOR 1221	---	72U	ug/Kg
11141-16-5	AROCLOR 1232	---	72U	ug/Kg
53469-21-9	AROCLOR 1242	---	72U	ug/Kg
12672-29-6	AROCLOR 1248	---	72U	ug/Kg
11097-69-1	AROCLOR 1254	---	72U	ug/Kg
11096-82-5	AROCLOR 1260	---	72U	ug/Kg
37324-23-5	AROCLOR 1262	---	72U	ug/Kg
11100-14-4	AROCLOR 1268	---	72U	ug/Kg

AK06193

Field/Station ID: D-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
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U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06193

Field/Station ID: D-2-2

Matrix: Soil

Date Received: 12/18/2008

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	71U	ug/Kg
11104-28-2	AROCLOR 1221	---	71U	ug/Kg
11141-16-5	AROCLOR 1232	---	71U	ug/Kg
53469-21-9	AROCLOR 1242	---	71U	ug/Kg
12672-29-6	AROCLOR 1248	---	71U	ug/Kg
11097-69-1	AROCLOR 1254	---	71U	ug/Kg
11096-82-5	AROCLOR 1260	---	71U	ug/Kg
37324-23-5	AROCLOR 1262	---	71U	ug/Kg
11100-14-4	AROCLOR 1268	---	71U	ug/Kg

AK06194

Field/Station ID: E-1-3

Matrix: Soil

Date Received: 12/18/2008

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	76U	ug/Kg
11104-28-2	AROCLOR 1221	---	76U	ug/Kg
11141-16-5	AROCLOR 1232	---	76U	ug/Kg
53469-21-9	AROCLOR 1242	---	76U	ug/Kg
12672-29-6	AROCLOR 1248	---	76U	ug/Kg
11097-69-1	AROCLOR 1254	---	76U	ug/Kg
11096-82-5	AROCLOR 1260	---	76U	ug/Kg
37324-23-5	AROCLOR 1262	---	76U	ug/Kg
11100-14-4	AROCLOR 1268	---	76U	ug/Kg

AK06195

Field/Station ID: E-2-2

Matrix: Soil

Date Received: 12/18/2008

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06200

Field/Station ID: B-1-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	77U	ug/Kg
11104-28-2	AROCLOR 1221	---	77U	ug/Kg
11141-16-5	AROCLOR 1232	---	77U	ug/Kg
53469-21-9	AROCLOR 1242	---	77U	ug/Kg
12672-29-6	AROCLOR 1248	---	77U	ug/Kg
11097-69-1	AROCLOR 1254	---	77U	ug/Kg
11096-82-5	AROCLOR 1260	---	77U	ug/Kg
37324-23-5	AROCLOR 1262	---	77U	ug/Kg
11100-14-4	AROCLOR 1268	---	77U	ug/Kg

AK06201

Field/Station ID: B-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

AK06202

Field/Station ID: B-3-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06195

Field/Station ID: E-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	69U	ug/Kg
11104-28-2	AROCLOR 1221	---	69U	ug/Kg
11141-16-5	AROCLOR 1232	---	69U	ug/Kg
53469-21-9	AROCLOR 1242	---	69U	ug/Kg
12672-29-6	AROCLOR 1248	---	69U	ug/Kg
11097-69-1	AROCLOR 1254	---	69U	ug/Kg
11096-82-5	AROCLOR 1260	---	69U	ug/Kg
37324-23-5	AROCLOR 1262	---	69U	ug/Kg
11100-14-4	AROCLOR 1268	---	69U	ug/Kg

AK06199

Field/Station ID: A-5-1

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	81U	ug/Kg
11104-28-2	AROCLOR 1221	---	81U	ug/Kg
11141-16-5	AROCLOR 1232	---	81U	ug/Kg
53469-21-9	AROCLOR 1242	---	81U	ug/Kg
12672-29-6	AROCLOR 1248	---	81U	ug/Kg
11097-69-1	AROCLOR 1254	---	81U	ug/Kg
11096-82-5	AROCLOR 1260	---	81U	ug/Kg
37324-23-5	AROCLOR 1262	---	81U	ug/Kg
11100-14-4	AROCLOR 1268	---	81U	ug/Kg

AK06200

Field/Station ID: B-1-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06202

Field/Station ID: B-3-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

AK06203

Field/Station ID: C-3-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

AK06204

Field/Station ID: G-2-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06204

Field/Station ID: G-2-2

Matrix: Soil

Date Received: 12/18/2008

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

AK06205

Field/Station ID: BG-1-1

Matrix: Soil

Date Received: 12/18/2008

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	97U	ug/Kg
11104-28-2	AROCLOR 1221	---	97U	ug/Kg
11141-16-5	AROCLOR 1232	---	97U	ug/Kg
53469-21-9	AROCLOR 1242	---	97U	ug/Kg
12672-29-6	AROCLOR 1248	---	97U	ug/Kg
11097-69-1	AROCLOR 1254	---	97U	ug/Kg
11096-82-5	AROCLOR 1260	---	97U	ug/Kg
37324-23-5	AROCLOR 1262	---	97U	ug/Kg
11100-14-4	AROCLOR 1268	---	97U	ug/Kg

AK06206

Field/Station ID: B-4-3

Matrix: Soil

Date Received: 12/18/2008

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06206

Field/Station ID: B-4-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	82U	ug/Kg
11104-28-2	AROCLOR 1221	---	82U	ug/Kg
11141-16-5	AROCLOR 1232	---	82U	ug/Kg
53469-21-9	AROCLOR 1242	---	82U	ug/Kg
12672-29-6	AROCLOR 1248	---	82U	ug/Kg
11097-69-1	AROCLOR 1254	---	82U	ug/Kg
11096-82-5	AROCLOR 1260	---	82U	ug/Kg
37324-23-5	AROCLOR 1262	---	82U	ug/Kg
11100-14-4	AROCLOR 1268	---	82U	ug/Kg

AK06207

Field/Station ID: RB-02

Date Received: 12/18/2008

Matrix: Aqueous

Sample Description: RINSATE

Analysis Type: PCBS TCL GC SOM1.1 AQUEOUS

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	0.031U	ug/L
11104-28-2	AROCLOR 1221	---	0.063U	ug/L
11141-16-5	AROCLOR 1232	---	0.031U	ug/L
53469-21-9	AROCLOR 1242	---	0.031U	ug/L
12672-29-6	AROCLOR 1248	---	0.031U	ug/L
11097-69-1	AROCLOR 1254	---	0.031U	ug/L
11096-82-5	AROCLOR 1260	---	0.031U	ug/L
37324-23-5	AROCLOR 1262	---	0.031U	ug/L
11100-14-4	AROCLOR 1268	---	0.031U	ug/L

AK06208

Field/Station ID: BG-2-1

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06208

Field/Station ID: BG-2-1

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	80U	ug/Kg
11104-28-2	AROCLOR 1221	---	80U	ug/Kg
11141-16-5	AROCLOR 1232	---	80U	ug/Kg
53469-21-9	AROCLOR 1242	---	80U	ug/Kg
12672-29-6	AROCLOR 1248	---	80U	ug/Kg
11097-69-1	AROCLOR 1254	---	80U	ug/Kg
11096-82-5	AROCLOR 1260	---	80U	ug/Kg
37324-23-5	AROCLOR 1262	---	80U	ug/Kg
11100-14-4	AROCLOR 1268	---	80U	ug/Kg

AK06209

Field/Station ID: A-1-1

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

CAS Number	Analyte Name	Result	Remark Codes	Units
12674-11-2	AROCLOR 1016	---	83U	ug/Kg
11104-28-2	AROCLOR 1221	---	83U	ug/Kg
11141-16-5	AROCLOR 1232	---	83U	ug/Kg
53469-21-9	AROCLOR 1242	---	83U	ug/Kg
12672-29-6	AROCLOR 1248	---	83U	ug/Kg
11097-69-1	AROCLOR 1254	---	83U	ug/Kg
11096-82-5	AROCLOR 1260	---	83U	ug/Kg
37324-23-5	AROCLOR 1262	---	83U	ug/Kg
11100-14-4	AROCLOR 1268	---	83U	ug/Kg

AK06210

Field/Station ID: A-2-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06210

Field/Station ID: A-2-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	150U	ug/Kg
11104-28-2	AROCLOR 1221	---	150U	ug/Kg
11141-16-5	AROCLOR 1232	---	150U	ug/Kg
53469-21-9	AROCLOR 1242	---	150U	ug/Kg
12672-29-6	AROCLOR 1248	---	150U	ug/Kg
11097-69-1	AROCLOR 1254	---	150U	ug/Kg
11096-82-5	AROCLOR 1260	---	150U	ug/Kg
37324-23-5	AROCLOR 1262	---	150U	ug/Kg
11100-14-4	AROCLOR 1268	---	150U	ug/Kg

AK06211

Field/Station ID: A-3-2

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	68U	ug/Kg
11104-28-2	AROCLOR 1221	---	68U	ug/Kg
11141-16-5	AROCLOR 1232	---	68U	ug/Kg
53469-21-9	AROCLOR 1242	---	68U	ug/Kg
12672-29-6	AROCLOR 1248	---	68U	ug/Kg
11097-69-1	AROCLOR 1254	---	68U	ug/Kg
11096-82-5	AROCLOR 1260	---	68U	ug/Kg
37324-23-5	AROCLOR 1262	---	68U	ug/Kg
11100-14-4	AROCLOR 1268	---	68U	ug/Kg

AK06212

Field/Station ID: A-4-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:



U.S. EPA Region 2 Laboratory
Data Report

Survey Name: JEWETT WHITE LEAD

Project Number: 08120050

*Sorted By Sample ID

AK06212

Field/Station ID: A-4-3

Date Received: 12/18/2008

Matrix: Soil

Sample Description:

Analysis Type: PCBS TCL GC SOM1.1 SOLID

<u>CAS Number</u>	<u>Analyte Name</u>	<u>Result</u>	<u>Remark Codes</u>	<u>Units</u>
12674-11-2	AROCLOR 1016	---	120U	ug/Kg
11104-28-2	AROCLOR 1221	---	120U	ug/Kg
11141-16-5	AROCLOR 1232	---	120U	ug/Kg
53469-21-9	AROCLOR 1242	---	120U	ug/Kg
12672-29-6	AROCLOR 1248	---	120U	ug/Kg
11097-69-1	AROCLOR 1254	---	120U	ug/Kg
11096-82-5	AROCLOR 1260	---	120U	ug/Kg
37324-23-5	AROCLOR 1262	---	120U	ug/Kg
11100-14-4	AROCLOR 1268	---	120U	ug/Kg

Project Approval: _____

Date: 2-3-09

Refer to Page 1 for an explanation of Remark Codes

Report Date: 1/29/2009 2:18PM